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This document presents an assessment of the potential environmental consequences of the development and subsequent operation of the MSX spacecraft and other related activities. Findings from the assessment determined no significant impact will result from conducting the MSX program.

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ENVIRONMENTAL ASSESSMENT

MIDCOURSE SPACE EXPERIMENT (MSX)

STRATEGIC DEFENSE
INITIATIVE ORGANIZATION

6 March 1992

ENVIRONMENTAL ASSESSMENT

MIDCOURSE SPACE EXPERIMENT (MSX)

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

6 March 1992

COVER SHEET

Responsible Agency:	Strategic Defense Initiative Organization
Proposed Action:	To develop, launch, and operate the Midcourse Space Experiment (MSX) spacecraft and to conduct a target program and other supporting activities.
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Designation:	Environmental Assessment
Abstract:	The Strategic Defense Initiative Organization (SDIO) is proposing to operate the MSX spacecraft to gather information related to the following objectives: demonstration of midcourse sensor functions; collection of midcourse target and background data; integration of critical sensor technologies; and demonstration of space surveillance capabilities. The data gathered will be used to design midcourse sensors. The proposed action is to develop, launch, and operate the MSX spacecraft and to conduct a target program and other supporting activities. Activities required to support this program include: 1) fabrication, assembly, and testing of the experiments at Utah State University/Space Dynamics Laboratory (USU/SDL), Johns Hopkins University/Applied Physics Laboratory (JHU/APL), and Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL); and 2) the launch and subsequent operation of the MSX spacecraft. This action will use existing facilities at USU/SDL, JHU/APL, and MIT/LL. Minor construction will be required at JHU/APL to install a ten-meter parabolic antenna and antenna support structure.
Availability:	April 1992

6 March 1992

FINDING OF NO SIGNIFICANT IMPACT

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

U.S. DEPARTMENT OF DEFENSE

Agency: U.S. Department of Defense
Strategic Defense Initiative Organization (SDIO)

Action: To develop, launch, and operate the Midcourse Space Experiment (MSX) spacecraft and to conduct a target program and other supporting activities.

Background: Pursuant to Council on Environmental Quality Regulations (40 CFR 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C. 4321 et. seq.), and the U.S. Department of Defense (DOD) Directive 6050.1, the Strategic Defense Initiative Organization (SDIO) has conducted an assessment of the potential environmental consequences of the development and subsequent operation of the MSX spacecraft and other related activities.

The Strategic Defense Initiative Organization is proposing to operate the MSX spacecraft to gather information related to the following objectives: demonstration of infrared and visible midcourse sensor functions; collection of multi-spectral midcourse target and background data; integration of critical sensor technologies; and demonstration of space surveillance capabilities. These purposes will be accomplished through the use of the Space Infrared Imaging Telescope (SPIRIT III) and other instrumentation that will be launched on the MSX spacecraft on a Delta II booster from Vandenberg Air Force Base (AFB) into a polar orbit. MSX will observe a variety of targets, both dedicated and nondedicated.

In addition to the dedicated targets, the MSX program will involve several cooperative targets and various targets of opportunity. These targets, however, are not driven by or attributable to MSX. Ancillary sensors will be used to verify and validate the MSX sensor data. Activities by these ancillary sensors will be conducted as part of their normal program operations.

Fabrication, assembly, and testing activities for the experiments to be contained on the MSX spacecraft will be conducted at Utah State University/Space Dynamics Laboratory (USU/SDL), Johns Hopkins University/Applied Physics Laboratory (JHU/APL), and Massachusetts Institute of Technology/Lincoln Laboratories (MIT/LL). The proposed activities will be conducted in existing facilities and will be within the scope of activities routinely conducted at those facilities. Existing facilities will be used at USU/SDL, JHU/APL, and MIT/LL. Minor construction will be required at JHU/APL to install a ten-meter parabolic antenna and antenna support structure.

Integration and testing activities for the spacecraft will occur at JHU/APL and the National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC). Following these activities the spacecraft will be purged of any leftover fluids and shipped via C-5A military cargo aircraft to Vandenberg AFB, where it will be launched into a polar orbit on a Delta II rocket. The preflight and flight activities required for the launch will be conducted at Vandenberg AFB in existing facilities developed specifically for such activities.

Alternatives considered include no action, the use of other launch locations, and the use of other launch vehicles. The no action alternative was rejected because mission requirements for midcourse sensors development would not be met without data from actual flight testing of the instrumentation aboard MSX. Vandenberg AFB was selected as the launch location because it is the only United States location with the capability to support medium launch vehicles and to deliver payloads directly into polar orbit. MSX mission parameters call for a polar orbit in order to observe atmospheric phenomena at various earth latitudes. The other site considered, Cape Canaveral Air Force Station (CCAFS), is limited to launching vehicles into an easterly azimuth. While an inflight change to a polar orbit is possible, it would increase the fuel expenditure, thereby reducing the maximum orbital altitude to below MSX mission requirements. The Delta II booster vehicle was chosen over other launch vehicles in its class (Atlas and Titan II) based on mission performance,

reliability, and schedule requirements. The Space Shuttle was also eliminated because it does not launch into a polar orbit from CCAFS.

Findings:

The potential for significant impacts was determined through an analysis of the activities that would be conducted at the proposed locations. The potential impacts of the proposed action were assessed against the following environmental media: physical setting and human environment; geology and water resources; air quality; noise; biological resources; threatened and endangered species; cultural resources; infrastructure; hazardous materials and waste; and public health and safety. The methodological approach consisted of identifying potential environmental issues and determining their significance. For issues identified as potentially significant after application of standard engineering practices, planned mitigation measures were incorporated into the program.

Minor construction is required at JHU/APL to install a ten-meter parabolic antenna and antenna support structure. A small area will be trenched for utility lines and a 40-foot by 40-foot area will be developed for a concrete pad to support the radar tower. The proposed construction of the antenna has the potential to affect land use on the JHU/APL site. The site plan for the antenna has been approved by Howard County, Maryland, and full County approval is expected upon submittal of construction drawings. No significant impact to land use is foreseen.

Impacts to public health and safety may occur as a result of the electromagnetic radiation emitted from the newly installed antenna. To prevent personnel from being exposed to radiation levels above the JHU/APL limit, the antenna will include a programmable horizon lockout (i.e., control of the beam angle relative to the horizon), and the support structure will include an audible warning to personnel. A post-installation survey will be performed to ensure that power densities are within the JHU/APL limit. Impacts to public health and safety will be not significant.

The spacecraft prelaunch and launch activities will be conducted at existing Vandenberg AFB facilities developed specifically for such activities. No significant impacts will occur as a result of these activities.

Prelaunch and launch activities of the Delta II booster will be conducted at Vandenberg AFB at existing facilities developed specifically for such activities. These activities were assessed in the *Environmental Assessment for the Modification and Operation of SLC-2W, Medium Expendable Launch Vehicle Services* (NASA, 1991), which is incorporated by reference into this EA. The analysis concluded there would be no significant impacts from the construction at the SLC-2W pad and subsequent launches of the Delta II, provided that launches do not occur during the 4 1/2-month nesting season of the California Least Tern, which nests from mid-April to the end of August. The Delta II launch schedule for MSX is consistent with the allowable launch window identified in the SLC-2W EA.

The dedicated targets will be launched on boosters such as Strategic Target Systems (STARS) and Minuteman I (MMI). Only boosters with completed environmental documentation would be used. Specific targets may include: aeroshells, lightweight replicas, instrumented balloons, emissive and reflective spheres, chaff, debris fragments, and hydrazine fuel. Two of the dedicated target payloads will be Operational and Deployment Experiments Simulator (ODES) configuration payloads; one will be a fuel vent experiment payload, and one will be a simulated reentry vehicle. These dedicated targets are covered by existing environmental documentation. No significant impacts are expected to result from use of STARS, ODES, and MMIs for MSX, or from MSX dedicated target sets.

Cumulative impacts were evaluated at MSX fabrication, assembly, and integration testing locations, the spacecraft launch and range location, and locations and ranges for dedicated targets. Cumulative impacts will be avoided through selection of MSX activities that have been assessed programmatically and through compliance with applicable regulations at MSX locations.

Overall, no significant impact will result from conducting the MSX program. Therefore, no environmental impact statement will be prepared for the proposed action.

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Dated: _____

_____
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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

The Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, and direct the research and testing of technologies applicable to developing a ballistic missile defense. In the 1991 State of the Union address, the President announced that the Strategic Defense Initiative (SDI) would be refocused to reflect the changing nature of threats to United States interests. This new focus on limited ballistic missile defense will consist of ground- and space-based elements to ensure continuous global detecting, tracking, and intercepting of ballistic missiles and their associated warheads. To develop an effective and viable program, the SDIO needs to demonstrate the capability to acquire and track midcourse targets against realistic backgrounds at system-representative distances, trajectories, and altitudes. The Midcourse Space Experiment (MSX) will integrate and functionally demonstrate state-of-the-art technologies for system elements. MSX is the only major midcourse mission planned; it is a necessary demonstration-validation mission for the development of defense against limited ballistic missile strikes.

The Proposed Action

The Strategic Defense Initiative Organization is proposing to operate the MSX spacecraft to gather information related to the following objectives: demonstration of infrared and visible midcourse sensor functions; collection of multi-spectral midcourse target and background data bases; integration of critical sensor technologies; and demonstration of space surveillance capabilities. These purposes will be accomplished through the use of the Space Infrared Imaging Telescope (SPIRIT III) and other instrumentation that will be launched on the MSX spacecraft

on a Delta II booster from Vandenberg Air Force Base (AFB) into a polar orbit. MSX will observe a variety of targets, both dedicated and nondedicated.

In addition to the dedicated targets, the MSX program will involve several cooperative targets and various targets of opportunity. These targets, however, are not driven by or attributable to MSX. Ancillary sensors, such as Air Force Maui Optical Station (AMOS), will be used to verify and validate the MSX sensor data. Activities by these sensors will be conducted as part of their normal program operations.

Fabrication, assembly, and testing activities for the experiments to be contained on the MSX spacecraft will be conducted at Utah State University/Space Dynamics Laboratory (USU/SDL), Johns Hopkins University/Applied Physics Laboratory (JHU/APL), and Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL). The proposed activities will be conducted in existing facilities and will be within the scope of activities that are routinely conducted at those facilities. Minor construction will be required at JHU/APL to install a ten-meter parabolic antenna and antenna support structure.

Integration and testing activities for the spacecraft will occur at JHU/APL and the National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC). Following these activities, the spacecraft will be purged of any leftover fluids and shipped via C-5A military cargo aircraft to Vandenberg AFB, where it will be launched into a polar orbit on a Delta II rocket. The preflight and flight activities required for the launch will be conducted at Vandenberg AFB at existing facilities developed specifically for such activities.

Alternatives

Alternatives considered include no action, the use of other locations, and the use of other launch vehicles. The no action alternative was rejected because it would make the actual flight test data anticipated to result from the experiments unavailable for the continued development of space-based sensors. The mission requirements for midcourse sensors development would not be met. Vandenberg AFB was selected as the launch location because it is the only United States location with the capability to support medium launch vehicles and to deliver payloads directly into polar orbit. MSX mission parameters call for a polar orbit in order to observe atmospheric phenomena at various earth latitudes. The other site considered, Cape Canaveral Air Force Station (CCAFS), is limited to launching vehicles into an easterly azimuth. An inflight change to a polar orbit is possible, but would increase the fuel expenditure, thereby reducing the maximum orbital altitude to below MSX mission requirements. The Delta II booster vehicle was chosen over other launch vehicles in its class (Atlas and Titan II) based on mission performance, reliability, and schedule requirements. The Space Shuttle was also eliminated because it does not launch into a polar orbit from CCAFS.

Analysis of Impacts

The potential for significant impacts was determined through an analysis of the activities that would be conducted at the proposed locations. As a result of that analysis, the impacts of the proposed action were assessed against the following selected environmental media: physical setting and man-made environment; geology and water resources; air quality; noise; biological resources; threatened and endangered species; cultural resources; infrastructure; hazardous materials and waste; and public health and safety. The methodological approach consisted of identifying potential environmental issues and determining their significance. For issues

identified as potentially significant after application of standard engineering practices, planned mitigation measures were incorporated into the program.

Minor construction is required at JHU/APL to install a ten-meter parabolic antenna and antenna support structure. A small area will be trenched for utility lines and a 40-foot by 40-foot area will be developed for a concrete pad to support the radar tower. Impacts to land use may occur as a result of the antenna siting at JHU/APL. No issues have been revealed through the county permit review process, which includes the Planning, Public Works, and Engineering Departments. Impacts to land use at JHU/APL and the surrounding area will not be significant.

Impacts to public health and safety may occur as a result of the electromagnetic radiation emitted from the antenna. To prevent personnel from being exposed to radiation levels above the JHU/APL limit, the antenna will include a programmable horizon lockout (i.e., control of the beam angle relative to the horizon) and the support structure will include an audible warning to personnel. A post-installation survey will be performed to ensure that the radio frequency (RF) levels are within the JHU/APL limit. Impacts to public health and safety will be not significant.

The spacecraft prelaunch and launch activities will be conducted at Vandenberg AFB at existing facilities developed specifically for such activities. No significant impacts will occur as a result of these activities.

Prelaunch and launch activities of the Delta II booster will be conducted at Vandenberg AFB at existing facilities that have been developed specifically for such activities. These activities were assessed in the *Environmental Assessment (EA) for the Modification and Operation of Space-Launch Complex (SLC-2W), Medium Expendable Launch Vehicle Services* (NASA, 1991). The SLC-2W EA is incorporated by reference into this EA. Mitigation presented in the SCL-2W

EA for protection of the California Least Tern by not launching during its 4 1/2 month nesting season is adopted by the MSX Program.

Dedicated targets will be launched on boosters such as the Strategic Target Systems (STARS) and Minuteman I (MMI). Only boosters with completed environmental documentation will be used. Specific targets may include: aeroshells, lightweight replicas, instrumented balloons, emissive and reflective reference spheres, chaff, debris fragments, and hydrazine fuel. Two of the dedicated target payloads will be Operational and Deployment Experiments Simulator (ODES) configuration payloads; one will be a fuel vent experiment payload, and one will be a simulated reentry vehicle. These dedicated targets are covered by existing environmental documentation. No significant impacts are expected to result from use of STARS, ODES, and MMIs for MSX, or from MSX dedicated target sets.

Cumulative impacts were evaluated at MSX fabrication, assembly, and integration testing locations, the spacecraft launch and range location, and locations and ranges for dedicated targets. Cumulative impacts will be avoided through selection of MSX activities that have been assessed programmatically and through compliance with applicable regulations at MSX locations.

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LIST OF ACRONYMS

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AFB	Air Force Base
AMOS	Air Force Maui Optical Station
ANSI	Amermican National Standards Institute
ARAR	Accident Risk Assessment Report
ATG	Aerospace Test Group
BE	Brilliant Eyes
BOA	Broad Ocean Area
CCAFS	Cape Canaveral Air Force Station
CE	Contamination Experiment
CEQ	Council on Environmental Quality
cfe	consolidated front end
CFR	Code of Federal Regulations
CSTC	Consolidated Space Test Center
DOD	Department of Defense
DOPAA	Description of Proposed Action And Alternatives
DOT	Department of Transportation
EA	Environmental Assessment
EDX	Exoatmospheric Discrimination Experiment
E^2I	Endo-Exoatmospheric Interceptor
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
ESQD	Explosive Safety Quantity Distance
ER	Eastern Range
FONSI	Finding of No Significant Impact
GBI	Ground Based Interceptor
GHA	Ground Hazard Area
GSFC	NASA/Goddard Space Flight Center
GSTS	Ground-based Surveillance and Tracking System
HALO/IRIS	High Altitude Learjet Observatory and Infrared Instrumentation System
ICBM	Intercontinental Ballistic Missile
JHU/APL	John Hopkins University/Applied Physics Laboratory
KSC-V	Kennedy Space Center-Vandenburg
KTF	Kauai Test Facility
KREMS	Kieman Reentry Measurement Site
LEO	Low Earth Orbit
LV	Launch Vehicle
LWIR	Long Wavelength Infrared

μCi	microcurie
MCC	Mission Control Center
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratory
mJ	millijoule
mW/cm^2	milliwatts per square centimeter
MMI	Minuteman I
MPC	Mission Processing Center
MSX	Midcourse Space Experiment
NASA	National Aeronautics and Space Administration
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	Oxides of Nitrogen
nm	nanometer
nmi	nautical mile
NRL	Naval Research Laboratory
OAMP	Optical Aircraft Measurement Program
ODES	Operational and Deployment Experiments Simulator
OSDP	Onboard Signal Data Processor
PBV	Post Boost Vehicle
PCF	Payload Command Facility
PM	Particulate Matter
PPF	Payload Processing Facility
ppm	parts per million
PSD	Prevention of Significant Deterioration
QCM	Quartz-Crystal Microbalance
RADOT	Recording Automatic Ditigal Optical Trackers
REC	Record of Environmental Consideration
RF	radio frequency
RP-1	kerosene
RV	Reentry Vehicle
SAC	Strategic Air Command
SBCAPCD	Santa Barbara County Air Pollution Control District
SBV	Space Based Visible Surveillance Sensor
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SHPO	State Historic Preservation Officer
SLAMS	State and Local Air Monitoring Station
SLBM	Sea Launched Ballistic Missile
SLC	Space Launch Complex
SPIRIT III	Space Infrared Imaging Telescope

SPW	Space Wing
SSD	Space Systems Division
STARS	Strategic Target System
SUPER	Survivable Solar Power Subsystem (Module) Demonstrator
TNS	Sensor Technology Directorate/SDIO
TSP	Total Suspended Particulate
UDMH	Unsymmetrical Dimethyl Hydrazine
USAF	U.S. Air Force
USAKA	U.S. Army Kwajalein Atoll
USASDC	U.S. Army Strategic Defense Command
USU/SDL	Utah State University/Space Dynamics Laboratory
UVISI	Ultraviolet/Visible Imagers and Spectrographic Imagers
WSMC	Western Space and Missile Center
WR	Western Range

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

MIDCOURSE SPACE EXPERIMENT
ENVIRONMENTAL ASSESSMENT

The National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations that implement NEPA (40 CFR 1500-1508), and the U.S. Department of Defense (DOD) Directive 6050.1 require that DOD officials take into account environmental consequences when authorizing or approving major Federal actions in the United States. Accordingly, this environmental assessment (EA) analyzes the potential environmental consequences of all aspects of the proposed Midcourse Space Experiment (MSX).

Section 1.0 describes the purpose and need for the proposed action. Section 2.0 describes the proposed action and its alternatives, including the no-action alternative. For particular activities that have the potential to significantly affect the environment, mitigation measures are incorporated into the MSX program to reduce the potentially significant effects to insignificant levels. These mitigation measures will be implemented as a part of the MSX program. Section 3.0 describes the affected environment at installations and locations where the testing and launch activities will be conducted. Section 4.0 assesses the potential environmental consequences of the proposed action at these installations.

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, and direct the research and testing of technologies applicable to developing a ballistic missile defense. In the 1991 State-of-the-Union address, the President announced that the Strategic Defense Initiative (SDI) would be refocused to reflect the changing nature of threats to U.S. interests. This new focus on limited ballistic missile defense will consist of ground- and space-based elements to ensure continuous global detecting, tracking, and intercepting of ballistic missiles and their associated warheads. To develop an effective and viable program, the SDIO

needs to demonstrate the capability to acquire and track midcourse targets against realistic backgrounds at system- representative distances, trajectories, and altitudes. The ability to acquire targets in midcourse flight is essential to the effectiveness of the system. MSX will integrate and functionally demonstrate state-of-the-art technologies for system elements, as well as provide a comprehensive midcourse phenomenologies database. MSX is the only major midcourse mission planned; it is a necessary demonstration-validation mission for the development of defense against limited ballistic missile strikes (PRA, 1991b).

The purposes of the proposed MSX program are: demonstration of infrared and visible midcourse sensor functions; collection of multi-spectral midcourse target and background data; integration of critical sensor technologies; and demonstration of space surveillance capabilities (SDIO, 1990a). The primary objective of the MSX program is to resolve the above technology issues, which are critical to the success of midcourse sensor systems for key ground- and space-based elements in the system architecture. Using the instrumentation on the satellite on a mission lifetime of several years in polar orbit, MSX will provide functional demonstrations and integrate state-of-the-art technologies necessary for the development of the current system elements. MSX will aid the development of the following programs (and their functional equivalents): Brilliant Eyes (BE); Ground-Based Interceptor (GBI); Endo-Exoatmospheric Interceptor (E^2I); and the Ground-based Surveillance and Tracking System (GSTS) (SDIO, 1991a).

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The proposed action is to develop, launch, and operate the MSX spacecraft and to conduct a target program and other supporting activities. MSX is primarily a data-collection experiment, concentrating on the phenomenology of target detection and tracking. The MSX sensors will also gather both celestial and earth limb background data. These instruments, as well as ancillary ground sensors, will observe a series of dedicated and nondedicated targets. MSX will be a space-based sensor experiment, serving as a data-gathering tool for the ballistic missile defense sensor elements.

Activities required to support MSX are execution of component/assembly tests for the MSX spacecraft experiments, prelaunch and launch activities, on-orbit activities, and target activities. Minor construction will be required to upgrade the Satellite Communications Facilities at Johns Hopkins University/Applied Physics Laboratory (JHU/APL). The construction will include an antenna and support structure.

2.1.1 Concept and Background of MSX

In the 1980s, the Defensive Technologies Study, or Fletcher Study, concluded that the most effective strategic defensive systems would have multiple layers. The concept of multilayered defense continues as the conceptual cornerstone for SDIO. Specifically, the current system consists of layers referred to as boost/postboost, midcourse, and terminal. These layers correspond, respectively, to (1) the period of a ballistic missile's flight beginning with the thrusting of the booster and continuing on through the time its reentry vehicles (RVs) and possible decoys are deployed, (2) the relatively long period of time RVs and decoys coast along

their ballistic trajectories in space, and (3) the final period when the RVs reenter the atmosphere near their targets.

The goal of the program for limited ballistic missile defense is to intercept all the attacking warheads and deny any damage: a low leakage system. (Leakage is a measure of the number of warheads that penetrate the defense.) A successful intercept requires detecting and tracking a target, discriminating the target from decoys and debris, launching interceptors, hitting the target, and finally destroying the target. The preferred approach to reduce leakage is to deploy a multi-tiered defense, with each tier capable of independently performing the basic functions of threat detection, tracking, identification, pointing or weapon guidance, destruction, kill assessment, coordination, and self-defense. If an element within a single tier fails, the target leaks through to the next tier, where the defense has another chance to detect and intercept the target.

The leakage of RVs can best be reduced by using a system of layered sensors and interceptors based in space and on the ground. Space-based sensors can detect the booster and postboost vehicle (PBV) exhaust plumes or the RVs after release from the PBV, track the flight of these objects, and direct space-based or ground-based interceptors to intercept and destroy them. If the intercept is unsuccessful, then the terminal layer of defense (ground-based sensors and interceptors) can try to intercept the RVs before they reach their intended targets. The space-based sensors play an important role in this process.

The space-based sensors must be able to detect the plumes of the booster or PBV or the relatively cool RVs during flight. These sensors must also be able to determine whether or not the interceptor(s) destroyed the booster, PBV, or RV in flight (kill assessment) to enable the battle manager to determine whether or not to try to engage these objects with the terminal defenses. These sensors must also be capable of discriminating between RVs and decoys.

To perform these functions, several types of sensors are required that must be developed and tested in a realistic environment. The MSX program is designed to aid in the development and testing of these space- and ground-based sensor systems.

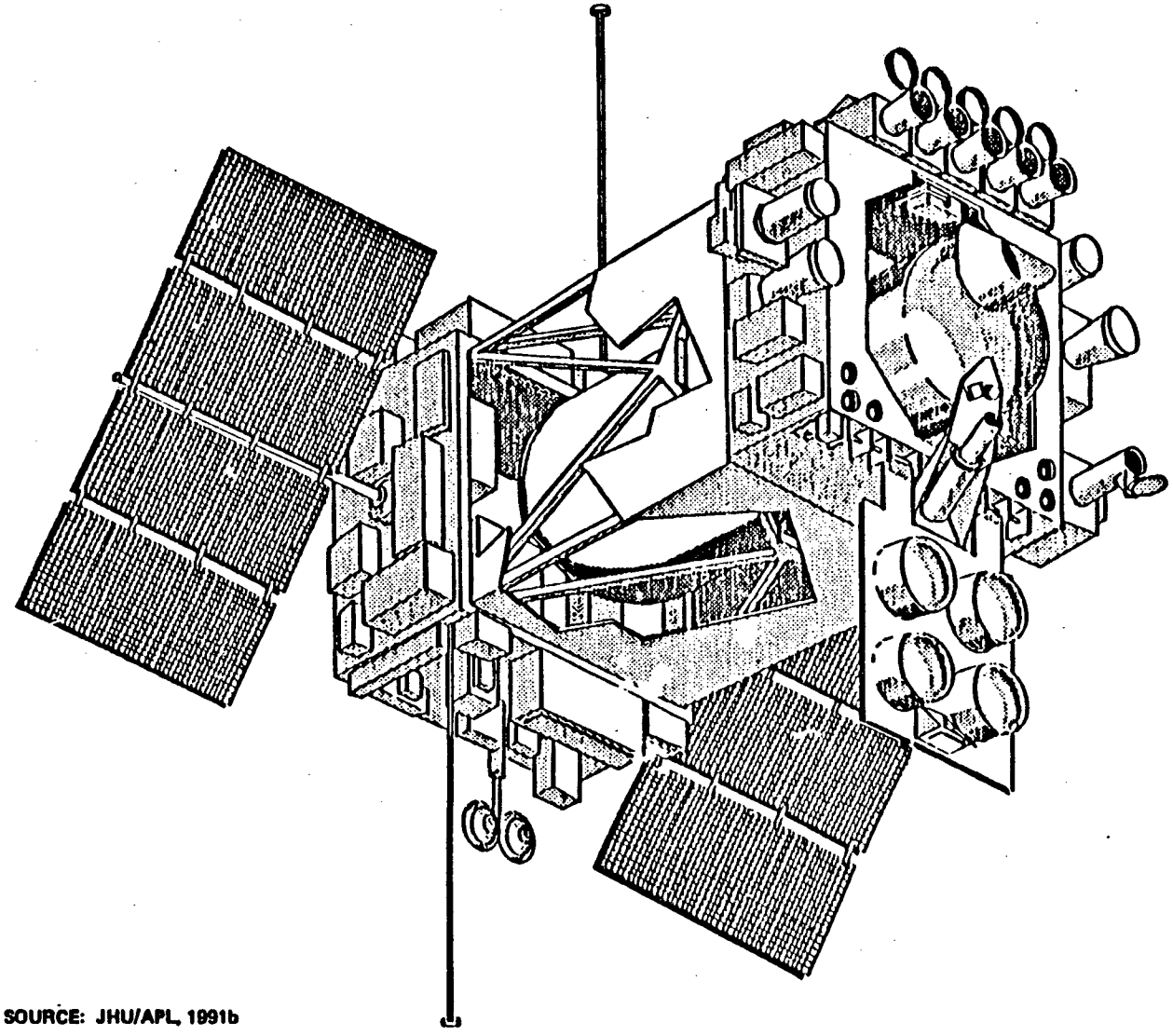
The MSX spacecraft (see Figure 2-1) will include as its primary payload the Space Infrared Imaging Telescope (SPIRIT III), a cryogenically cooled long wave infrared (LWIR) interferometer and radiometer developed by Utah State University/Space Dynamics Laboratory (USU/SDL). Secondary payloads will include a system of ultraviolet/visible imagers and spectrographic imagers (UVISI) developed by JHU/APL; a Space Based Visible (SBV) surveillance sensor developed by Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL); an onboard signal/data processor (OSDP) developed by SDIO/Sensor Technology Directorate (TNS); contamination sensors; and a mirror cleaning experiment.

The MSX spacecraft will be launched on a Delta II vehicle into an 888 km polar orbit from Vandenberg Air Force Base (AFB) (see Figure 2-2). This orbit was chosen to provide the desired background during the midcourse flight of the dedicated target launches, and build up a consistent database on sensor background over most regions of the globe.

The MSX spacecraft will be capable of collecting data for approximately five years, but will stay in orbit for several hundred years. It will acquire and track rockets, decoys, and penetration aids as they come into view, and the data obtained will be used to design midcourse sensors.

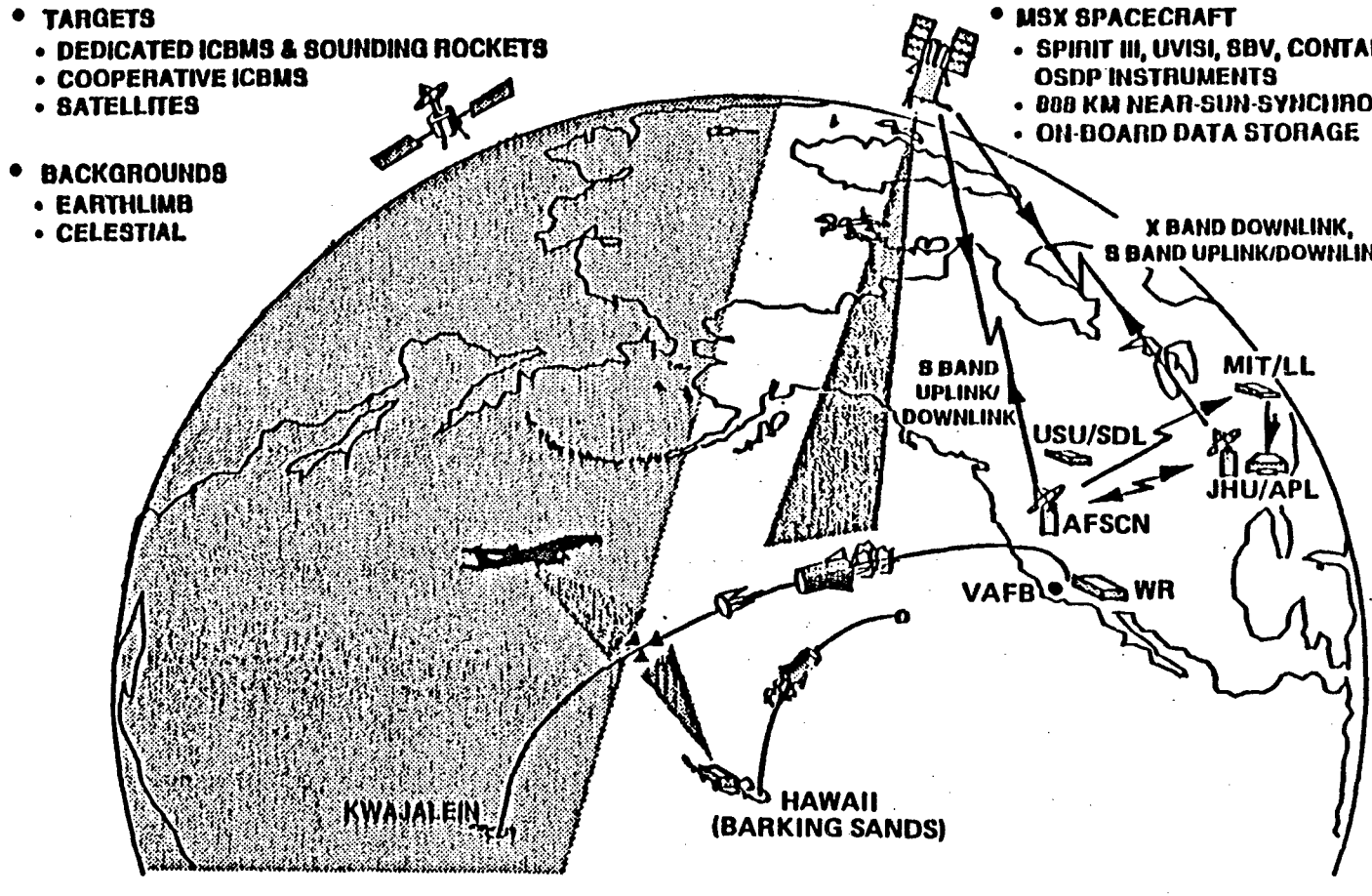
2.1.2 Component Assembly and Testing of the MSX Spacecraft Experiments

To support the MSX Program, component assembly and ground testing of the spacecraft experiments will occur at contractor and Government facilities in the continental United States. Table 2-1, MSX Activities and Locations, provides an overview of all the activities that are required for the MSX program, from the fabrication and assembly of the components to the



SOURCE: JHU/APL, 1991b

FIGURE 2-1
MSX SPACECRAFT ARTIST CONCEPT



SOURCE: JHU/APL, 1990a

FIGURE 2-2
MSX PROGRAM MISSION CONCEPT

TABLE 2-1

MSX ACTIVITIES AND LOCATIONS

ACTIVITY	LOCATION[1]					
	MIT/LL	USU/SDL	JHU/APL	GSFC	VAFB	KTF
Fabrication	-SBV -Reference Objects	-SPIRIT III	-Satellite[2] -UVISI			
Assembly	-SBV -Reference Objects	-SPIRIT III	-Satellite -UVISI			
Testing	-SBV -Reference Objects	-SPIRIT III -OSDP[2] -Mirror Cleaning Experiment[2]	-Satellite -UVISI -Contamination Experiment[2]			
Integration/ Testing			-Satellite -SPIRIT III -SBV -UVISI -Reference Objects -OSDP -Contamination Experiment -Mirror Cleaning Experiment			
Environmental Testing				-Satellite with all experiments/ instruments		
Satellite Prelaunch Integration/ Testing					-Delta II	
Satellite Launch					-Delta II	
Target Prelaunch Integration/ Testing					-Minuteman I	STARS
Target Launch					-Minuteman I	STARS

[1] Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL)
Utah State University/Space Dynamics Laboratory (USU/SDL)
John Hopkins University/Applied Physics Laboratory (JHU/APL)
NASA/Goddard Space Flight Center (GSFC)
Vandenberg Air Force Base (VAFB)
Kauai Test Facility (KTF)

[2] Satellite truss structure, OSDP, mirror cleaning experiment, and contamination experiment provided by subcontractors.

launch of the spacecraft. JHU/APL will provide MSX system engineering, satellite development, and payload integration. Therefore, JHU/APL is responsible for the overall design, fabrication, inspection, assembly, and testing of the satellite and its subsystems.

JHU/APL will provide system safety management to assure comprehensive risk assessment for the MSX spacecraft from design through launch. System safety management and engineering will be integrated with the overall MSX Program activities to minimize accident risks to personnel; the MSX spacecraft and its subsystems and instruments; the launch vehicle; facilities; and ground support equipment.

Potential safety hazards will be assessed for risk as early as possible. Recommended safety procedures will be incorporated into the program activities and plans. The hazards and safety procedures will be detailed for MSX in the following documents: MSX Integrated Safety Program Plan; National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Ground Safety Plan; Vandenberg AFB Ground Safety Plan; Western Space and Missile Center (WSMC) Regulation 127-1 Compliance Checklist; an Accident Risk Assessment Report; and a Test Operations Risk Assessment. Safety documentation for MSX will be available at all MSX activity sites (JHU/APL, 1992).

Review and approval of MSX Safety Documentation will be performed by 30th Space Wing and Kennedy Space Center-Vandenberg (KSC-V) for ground operations and by Consolidated Space Test Center (CSTC) for space operations.

JHU/APL is also responsible for the UVISI sensor and the Contamination Experiment (CE). The UVISI sensor will provide complete spectral and imaging capabilities from the far ultraviolet (100 nm) to the near infrared (900 nm) wavelengths. The UVISI is derived from a succession of ultraviolet and visible instruments previously flown on orbital missions by JHU/APL. It will have larger optics than earlier instruments and closed-loop tracking capability. The current

design gives the UVISI a design lifetime of four to five years. Components of the UVISI will be bought from outside sources and fabricated at JHU/APL in Buildings 13 and 14. Fabrication activities will use existing facilities, procedures, and personnel, and will consist of circuit board preparation, welding, and microelectronics laboratory activities (JHU/APL, 1990).

The CE will monitor contamination external to the spacecraft. It will provide input to determine when the onboard instruments should be turned on. It will also extend current spacecraft contamination models. The components of CE will be provided by subcontractors to JHU/APL, where assembly and testing activities will occur. Krypton and xenon flash lamps in the CE will contain a small amount of low-level Ni^{63} radioactive element. The Ni^{63} will serve as an ionizing source and will conserve power to the lamps. JHU/APL has the necessary use and possession licenses required for these materials. The amount of Ni^{63} is small enough to exempt it from Nuclear Regulatory Commission licensing and Department of Transportation (DOT) regulations (JHU/APL, 1991a).

USU/SDL will design, assemble, and test the SPIRIT III sensor, the primary payload package. The tests will be executed in existing specialized chambers that will simulate space conditions. Cold and warm environment tests, a cold calibration test, an integration test for the liquid hydrogen storage dewar (similar to a vacuum bottle or thermos), and hydrogen cold tests are the milestone tests planned for SPIRIT III (USU/SDL, 1991a). The operational lifetime of the SPIRIT III sensor will be approximately two years.

USU/SDL will also perform test activities for the Onboard Signal Data Processor (OSDP) and the CE. The OSDP will demonstrate real-time signal/data processing of LWIR data in space. It will perform time-dependent and object-dependent signal processing for a portion of the data from the SPIRIT III radiometer focal plane. The mirror cleaning experiment for the SPIRIT III mirror will consist of a pulsed CO_2 laser operating on a movable arm. The mirror cleaner is designed to restore mirror performance as near as possible to pre-flight levels. The primary

sources of degradation to the mirror will be from the spacecraft itself—heavy organic molecules "outgassing" from the spacecraft and from particles floating free from the spacecraft. Mirror contamination will also occur from dust and the small amounts of gasses found in space. The primary mirror will be cleaned on-orbit to test the cleaning concept.

MIT/LL will design and assemble the Space Based Visible (SBV) instrument. Components of the instrument will be fabricated in a clean room in Building I. Electronic simulation and assembly testing of the instrument will also occur at MIT/LL (MIT/LL, 1991b). The SBV sensor is designed to demonstrate an above-the-horizon surveillance capability from a space platform using a visible wavelength optical sensor. MIT/LL will also provide at least four reference objects. The reference objects will be used for instrument calibration purposes and to evaluate flight sensor performance and precision. The objects will be approximately 2 cm in diameter, be made of aluminum, and have an ejection velocity of 13 meters per second. They will be fabricated at MIT/LL in Building D, the Environmental Test Laboratory (MIT/LL, 1991a).

2.1.3 System Integration Testing Activities

The experiments discussed in Section 2.1.2 and their support and calibration equipment will be shipped via commercial truck and air carriers to JHU/APL for integration and testing. All shipments will consist of standard equipment and nonhazardous materials. Therefore, no special transportation permits will be required (MIT/LL, 1991a; USU/SDL, 1991a).

Integration of the experiments, as well as engineering testing, software checkout, and attitude control simulations for the spacecraft will be conducted at JHU/APL in Building 23. This building contains the clean rooms required for the system test and checkout procedures. Outdoor testing of the completed spacecraft's communications and other electronic systems will take place at JHU/APL's outdoor antenna test range. The SPIRIT III cryostat will be cooled with liquid

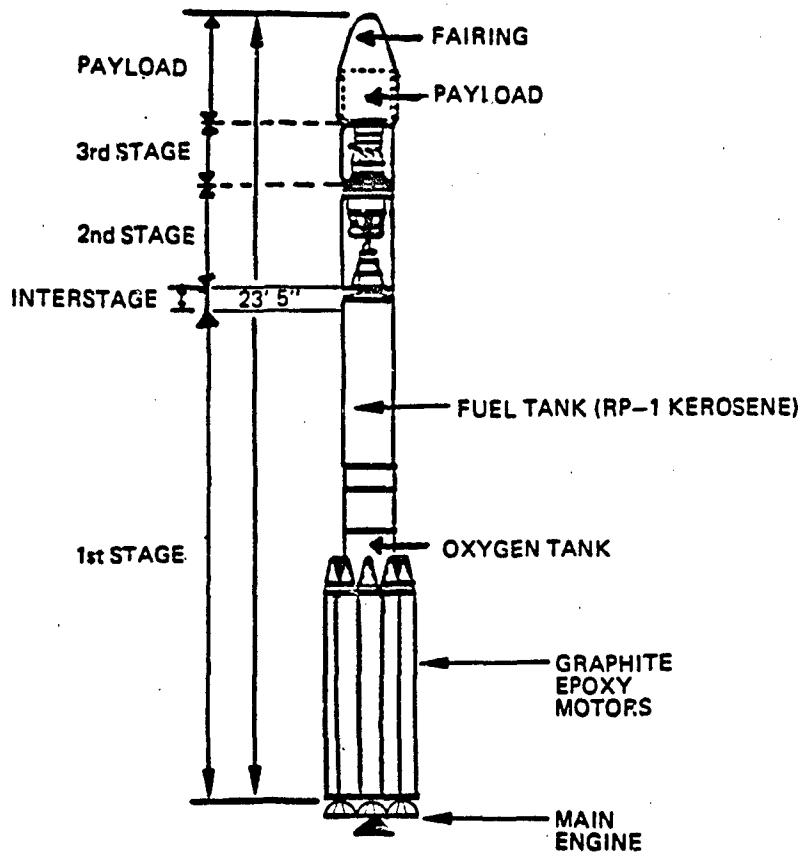
helium for the tests to be performed at JHU/APL and at the NASA/GSFC in Greenbelt, Maryland.

Once the initial integration tests listed above are completed, the spacecraft will undergo further testing to be conducted in existing indoor facilities at NASA/GSFC, Building 7. These tests include optical alignments and verifications; acoustical environment exposure; pyro-shock and deployments exposure; magnetic tests; launch vehicle (LV) and spacecraft separation tests; and thermal vacuum exposure tests (JHU/APL, 1990).

Following the integration and testing activities at JHU/APL and NASA/GSFC, the spacecraft will be purged of any leftover fluids used during the testing, transported by truck to Andrews AFB in Washington, D.C., and shipped via C-5A military cargo aircraft to Vandenberg AFB in California.

2.1.4 MSX Launch Vehicle and Flight Profile

The MSX spacecraft will be launched on a Delta II (7920 configuration) from Space Launch Complex-2West (SLC-2W) at Vandenberg AFB (see Figures 2-3 and 2-4). The SLC-2W is currently configured to launch Delta I vehicles. Refurbishment of the SLC-2W is planned during 1991 and 1992 to accommodate all future Delta II launches. The launch frequency of the Delta II program will be two per year, including the single MSX launch. Launches will not occur during the 4 1/2-month nesting season of the California Least Tern, which has its habitat in the coastal dunes to the west of SLC-2W, and nests from mid-April to the end of August. Construction and subsequent operation of SLC-2W is examined in the *Environmental Assessment for the modification and operation of SLC-2W, Medium Expendable Launch Vehicle Services* (NASA, 1991). The SLC-2W EA and Finding of No Significant Impact (FONSI) are incorporated by reference and summarized in the appropriate sections of this document. MSX



SOURCE: NASA, 1991

FIGURE 2-3
DELTA II LAUNCH VEHICLE CONFIGURATION

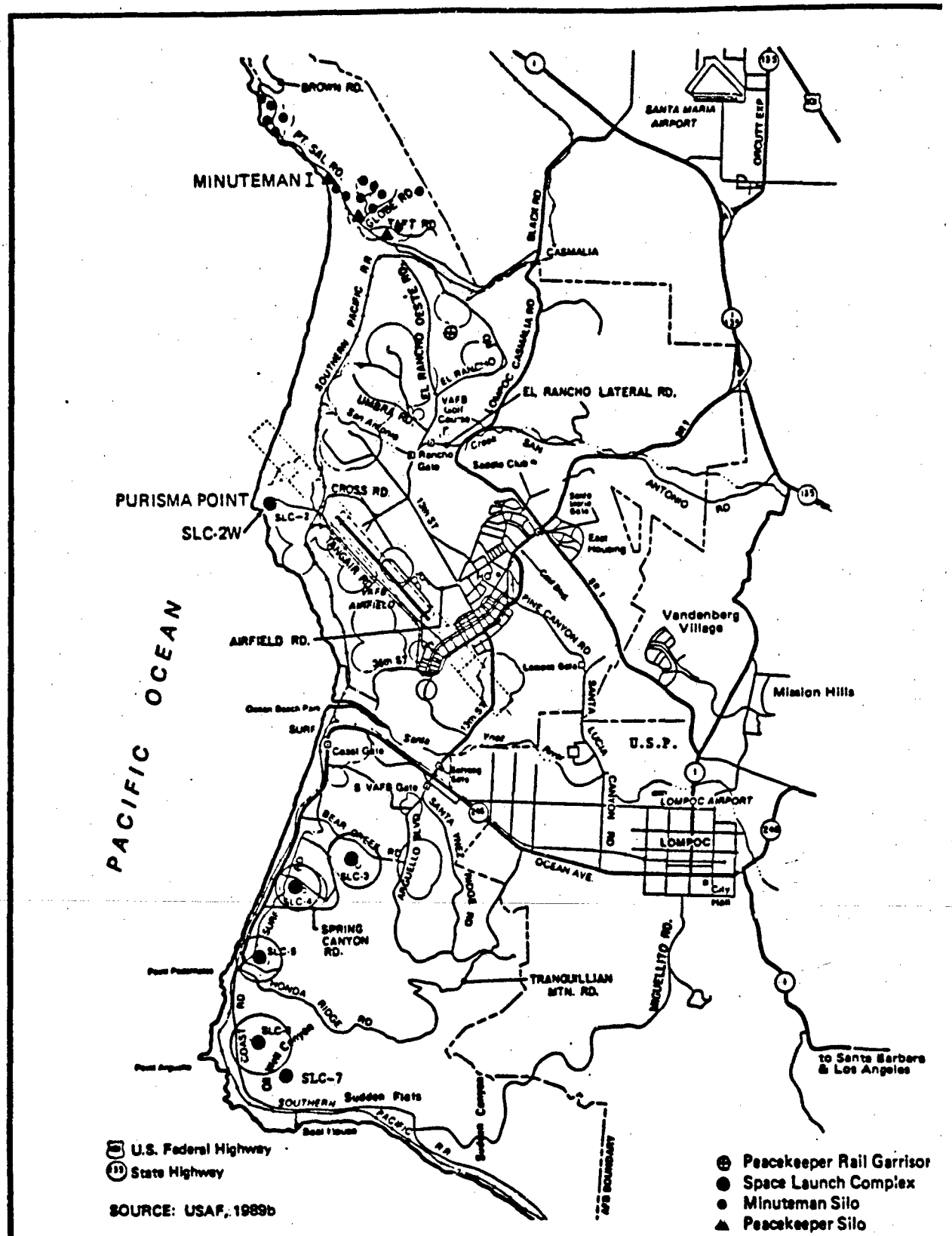


FIGURE 2-4
LOCATION OF SLC-2W ON VAFB

payload processing and handling are not covered in the SLC-2W EA and are summarized in the following sections.

2.1.5 Prelaunch and Launch Activities

Prelaunch activities extend from arrival of the spacecraft and launch vehicle at Vandenberg AFB to the time the vehicle is assembled, checked-out, and ready for launch. Prelaunch and launch activities for the Delta II launch are as assessed in the SLC-2W EA. Activities described in this section are attributable to the MSX payload.

The MSX spacecraft will be launched at a 99.16 degree inclination, 888 km polar orbit. This orbit will provide the desired background covering the whole globe for the sensor experiments during the midcourse flight.

The MSX spacecraft will arrive at Vandenberg AFB aboard a C-5 military cargo aircraft from Andrews AFB. The spacecraft itself will be transported to NASA Building 1610, known as the Payload Processing Facility (PPF), on the North Base portion of Vandenberg AFB. Accompanying ground support equipment will be transported to and installed in NASA Building 836, known as the Payload Command Facility (PCF), on South Base. The PPF houses the MSX spacecraft for the prelaunch operations (encapsulation, battery charging, etc.), while the PCF controls it during prelaunch testing. Building 7011 on North Base, operated by the 30th Space Wing (30SPW) is the primary node in an existing communications network linking the PPF and the PCF to each other, as well as to CSTC, to JHU/APL (via NASA/GSFC), and to the launch operations control center located in Building 7000.

All prelaunch processing will take place in the PPF. Activities will include: unpacking the spacecraft from its shipping container; charging the onboard nickel-hydrogen batteries; filling

the cryostat with solid hydrogen; verifying the alignment of the onboard optical systems; arming the onboard pyrotechnic systems (explosive bolts); and spacecraft encapsulation.

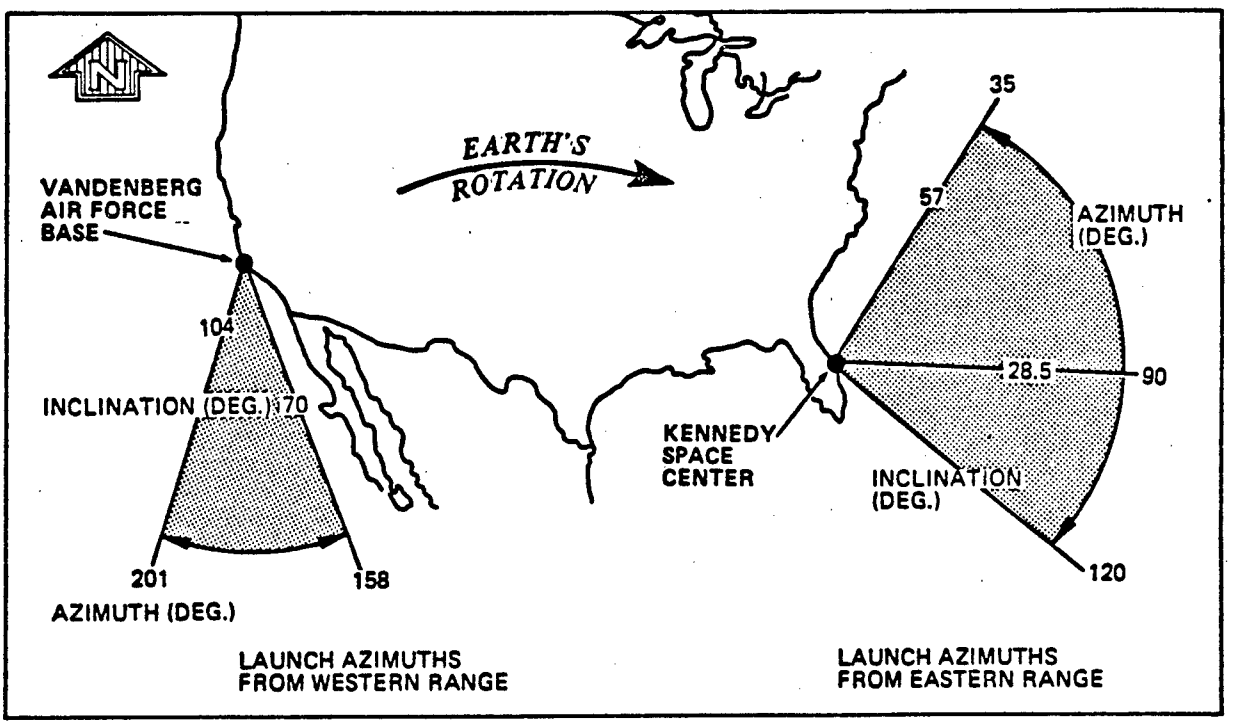
The encapsulated spacecraft will then be transported to the SLC-2W launch pad, where it will be mated with the Delta II launch vehicle. A series of preflight system verification tests, directed from the PCF, will follow. These tests will include a spacecraft electrical systems test and a radio-frequency interference test. The SPIRIT III door dewar will then be filled with cryogen (liquid argon) and the payload fairing installed, completing prelaunch preparation.

Launch activities extend from the launch countdown and launch through orbit insertion (spacecraft separation). Activities include: launch countdown and control; range safety booster tracking; and spacecraft orbit insertion verification.

2.1.5.1 Launch and Range Control

The specific information regarding the MSX launch azimuth, trajectory, and impact areas has not yet been developed. The launch will occur, however, within the range of polar launch azimuths from Vandenberg AFB as shown in Figure 2-5. These azimuths and Vandenberg AFB's geographic location allow the MSX spacecraft to be placed in a high inclination polar orbit without overflying heavily populated areas.

The MSX spacecraft will comply with the hardware and operational criteria in WSMC Regulation 127-1, thereby assuring safety during launch operations and the ascent phase (JHU/APL, 1990). Safety at the launch site and of the general public within the Western Range (WR) is the responsibility of the 30SPW/SE (Safety). Verification of compliance with range safety requirements will be documented in the Accident Risk Assessment Report to be prepared by JHU/APL.



SOURCE: USAF, 1989b

FIGURE 2-5
OVER-WATER ORBITAL LAUNCH AZIMUTHS POSSIBLE FROM THE TWO PRINCIPAL U.S. SPACE PORTS

2.1.5.2 Ground and Flight Safety

Safety plans for the Delta II launch vehicle will be developed by the vehicle contractor, in conjunction with the U.S. Air Force (USAF) 30SPW/SE and NASA. The safety plans will include standard operating procedures for storage, assembly, prelaunch, and launch operations. Key procedures will be included for solid and liquid fuels handling (both are used on the Delta II) at SLC-2W, ground safety area implementation, worker and spectator protection from noise and launch emissions, and range clearing/security for marine vessels and aircraft. These launch vehicle-specific procedures will be integrated with those for the MSX payload, particularly those for handling and venting cryogenic liquids.

2.1.6 On-Orbit Activities

On-orbit activities will begin at orbit insertion with the handover from Ground Operations to Flight Operations, the start up of spacecraft systems, and an evaluation of their operation. Once checkout, calibration, and characterization activities are completed, a mini-MSX mission will be conducted. This mission involves collecting data from all onboard experiments, over a period of several days, to verify operation of all systems (JHU/APL, 1990). Reference objects released from the MSX platform will be used to calibrate the SPIRIT III sensor (see Section 2.1.1). There will be no chemical releases for calibration purposes.

MSX mission experiments will extend from checkout through the end of the spacecraft's operational life, approximately five years. The lifetime of the SPIRIT III sensor is dependent upon the amount of available hydrogen cryogen. Hydrogen will be released to space on a regular basis from the dewar on the SPIRIT III sensor. Approximately a one quarter pound of hydrogen will be released per day, for a total of 172 pounds over the sensor lifetime, to maintain sensor operating temperature. Spacecraft orienting and aiming will be performed by four electrically powered reaction wheels. Liquid fuel will not be required for the attitude control.

Toward the end of the SPIRIT III sensor's lifetime (approximately two years), a contamination experiment and mirror cleaning experiment will be conducted on the spacecraft; there will be no chemical releases from these experiments. Laser power output is 285 millijoules (mJ) per 4-microsecond (μs) pulse in a 1-centimeter beam, with a pulse repetition of 2 hertz (Hz) (USU/SDL, 1992). The lifetimes of the other experiments are expected to be approximately five years.

JHU/APL will be the command and telemetry connection for the satellite once it is in orbit and requires a Mission Control Center (MCC) and Mission Processing Center (MPC). Data from the experiments will be recorded onboard and downlinked to JHU/APL and other existing earth stations. Radio transmission to the spacecraft and data transmission to the ground stations will not cause ground impacts, due to the broadening and weakening of the beam with distance. No lasers communication devices will be used. These on-orbit activities will be coordinated with the Consolidated Space Test Center (CSTC) at Onizuka AFB, California.

The spacecraft will remain on-orbit for several hundred years. Program plans for MSX do not require deorbit capability or deorbit plans, which is consistent with WSMC 127-1. CSTC will track MSX and identify when orbit degeneration will occur. Designs for the MSX spacecraft have minimized the amount of hazardous material carried aboard, and all expendables such as cryogens all expected to be consumed by the end of the MSX mission (PRA, 1992).

2.1.7 Spacecraft Control and Data Management Activities

The MCC at JHU/APL will be the command and telemetry connection for the satellite once it is in orbit. The Phillips Laboratory Geophysics Directorate (PL/GD), the MSX Data Manager, will be responsible for the design, development, implementation, and execution of the data management system (PRA, 1990b). PL/GD activities will extend from receiving raw telemetry data from the spacecraft to distributing system-related data products to the scientists and other

users (SDIO, 1990a). Initial processing of data will be done at the JHU/APL MPC. The data will then be sent to the SDIO Backgrounds Data Center at Naval Research Laboratory (NRL) in Washington, D.C. The processed information will also be sent to the Data Processing Centers at USU/SDL, JHU/APL, MIT/LL, and PL/GD (PRA, 1990b).

2.1.8 Dedicated Targets

Target payloads for the MSX sensors will be launched on dedicated boosters such as the Strategic Target System (STARS) and Minuteman I (MMI) (see Table 2-2) (PRA, 1991). Only boosters with completed environmental documentation will be used. Specific targets may include any of the following: aeroshells, lightweight replicas, instrumented balloons, emissive and reflective reference spheres, chaff, debris fragments, and unsymmetrical dimethyl hydrazine (UDMH) fuel. Two of the dedicated target payloads and will consist of Operational and Deployment Experiments Simulator (ODES) configuration payloads and one will be a fuel vent experiment payload. These three payloads are planned to be launched on three-stage STARS boosters from the Kauai Test Facility (KTF). A fourth target will be an experiment of reentry phenomenology, and is planned to be launched on a MMI booster from Vandenberg AFB. Minuteman Launch Facilities on North Vandenberg are shown on Figure 2-4. Flights that utilize the ODES payload as currently configured must use the STARS booster. Some target payloads may use either STARS or MMI. Targets will impact in the broad ocean area (BOA) off U.S. Army Kwajalein Atoll (USAKA).

STARS launches from the KTF were assessed in *Environmental Assessment - Strategic Target Systems (STARS)* (USASDC, 1990a) and its supplement (USASDC, 1991). The USASDC has also, in response to strong public interest, initiated work on an environmental impact statement (EIS) for the STARS program. The STARS EA found potentially significant, but mitigable, environmental impacts to archeological resources from construction activities; to the Newell's shearwater, a Federally listed threatened bird species, from the use of unshielded floodlights;

TABLE 2-2 MSX DEDICATED TARGETS SUMMARY

VEHICLE	DATA OBJECTIVE	LAUNCH/IMPACT
STARS/ODES	PBV deployment phenomenology, in darkness	KTF to USAKA
STARS/c.f.e	Fuel vent signature in outer atmosphere	KTF to USAKA
STARS/ODES	PBV deployment phenomenology, across terminator	KTF to USAKA
Minuteman I/c.f.e	RV re-entry phenomenology, in sunlight	VAFB to USAKA

c.f.e. = a "consolidated front end," a simple top-stage without the sophisticated capabilities of a true PBV like ODES

to biological resources and human safety from the use of liquid propellants; and to vegetation from the high exhaust temperatures associated with the STARS launch. No potential for significant impacts was found to other environmental media. Impacts of spent components and debris will occur in the broad ocean area between KTF and USAKA. Use of ODES targets on the STARS was also the subject of *Record of Environmental Consideration (REC), Operational and Deployment Experiments Simulator (ODES)* (USASDC, 1990b). Launch profiles and target characteristics for dedicated MSX launches were compared to, and found to be consistent with, those assessed in the STARS EA and supplement and the ODES REC; no significant impacts would be expected to result from use of STARS and ODES for MSX.

Launch, flight tracking, and other range control operations for MMI missiles from Vandenberg AFB are part of the ongoing operations at Vandenberg AFB using existing facilities, and are assessed in *Environmental Assessment for Minuteman and Thor Missile Launches at Vandenberg AFB, California* (USAF, 1976). No construction or other ground-disturbing activities will be required for MMI launches for MSX. Impacts resulting from spent components and debris will occur in the broad ocean area between Vandenberg AFB and USAKA. The referenced analyses concluded that no impacts would result to cultural resources, infrastructure, socioeconomic, hazardous waste, or water quality from MMI flight activities. MMI flights have the potential to impact air quality, biological resources, land use, noise and public health and safety; however, no significant individual or cumulative impacts were found. MMI launches and target payloads for MSX are comparable to those assessed in the referenced EA and routinely experienced at Vandenberg AFB; no significant impacts from MSX would be expected to result from the use of MMI missiles.

2.1.9 Non-Dedicated Targets

In addition to the dedicated targets discussed above, the MSX program will involve several cooperative targets and various targets of opportunity. While these targets are not driven by or attributable to MSX, a description of their relationship to MSX is included for completeness.

A cooperative target program that will be used by MSX to measure signature data is the Exoatmospheric Discrimination Experiment (EDX) (USASDC, 1990c). MSX will view four EDX flights launched on MMI missiles that will deploy a variety of RVs and penaids. Each EDX booster and sensor payload is to be launched from KTF,and a target complex will be released from a MMI missile launched from Vandenberg AFB, California. For these joint MSX/EDX encounters, EDX will be the primary source of high-quality LWIR target signature data, while the MSX will provide functional demonstration of midcourse sensor acquisition, tracking and discrimination. MSX will also provide additional target signature data in the LWIR, visible, and ultraviolet spectra.

Targets of opportunity will be viewed by MSX as circumstances permit. These are expected to include other programs with target launches, as well as other events of interest, and could include other SDIO experiment programs, Strategic Air Command (SAC) Intercontinental Ballistic Missile (ICBM) tests, Navy Sea Launched Ballistic Missile (SLBM) tests, NASA experiments, Shuttle launches and payload deployments, other Eastern Range (ER) and Western Range (WR) launches, and commercial launches.

MSX interaction with cooperative targets and targets of opportunity will include coordination of launch and event times, communications, and data transmission, and will be conducted as a part of normal program operations (JHU/APL, 1990). No potentially significant impacts will be induced by either the MSX satellite operations or the response of the nondedicated targets.

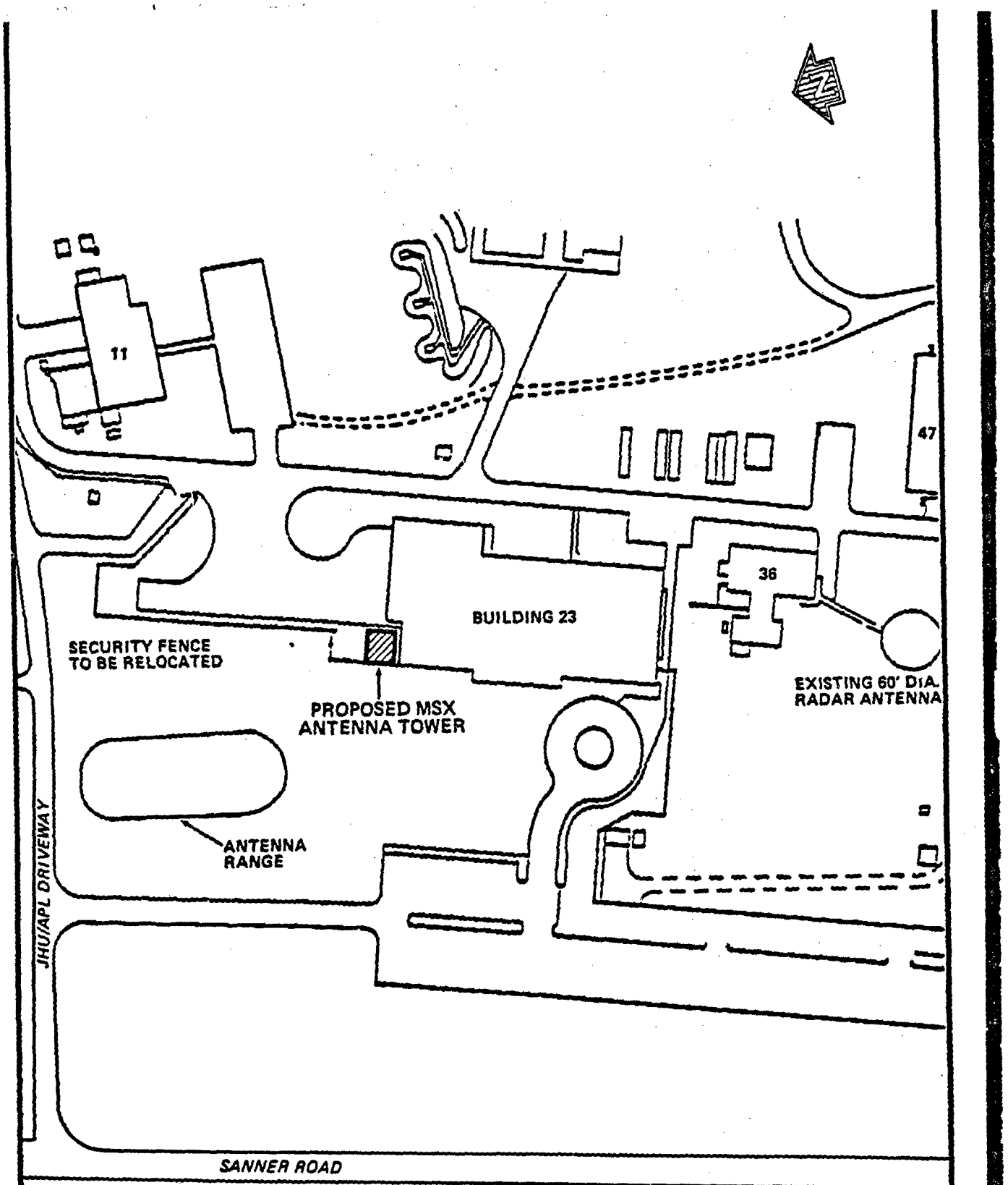
2.1.10 Ancillary Sensors

In addition to the target and spacecraft instrumentation, several ancillary sensors will be utilized on a mission-by-mission basis for obtaining corollary measurements to aid in post-mission analyses. These sensors include, but are not limited to: AMOS, KREMS, Cobra Judy, AOA/AST, ARGUS, OAMP, HALO/IRIS, SUPER RADOT, PL/GD KC-135, and DARPA Music AIRCRAFT. Activities by these ancillary sensors will be conducted as part of their normal program operation.

2.1.11 Construction

JHU/APL, as the planning and operations ground control site, will control the telemetry interaction with the satellite once it is in orbit. The JHU/APL facility will be upgraded to include a 10-meter parabolic dish antenna and antenna support structure. The purpose of the antenna will be to provide a space/ground link system for the MSX program. The MSX program requires that the antenna collect data during a high percentage of each pass of the polar orbit. Therefore, the antenna must be elevated to provide horizon-to-horizon coverage unobstructed by JHU/APL buildings. The antenna and support structure will be located inside a security perimeter fence, immediately adjacent to building 23 (see Figure 2-6). The structure will be 43 feet high (approximately 4 stories), and have a 40-foot square base, and be open-framed with no side covering (see Figure 2-7).

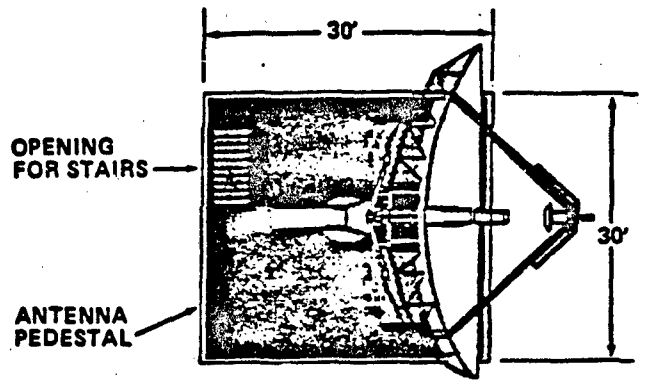
After the antenna support structure is built, a contractor, Scientific Atlanta, will install the antenna with pedestal and an equipment shelter. Electrical power will be supplied to the antenna pedestal from a commercial power source located adjacent to the JHU/APL road system on the other side of Building 23. Power will be ensured by an uninterruptible power supply located in Building 36 that houses the MCC/MPC. Other signal cables connecting transmitting and receiving equipment located in the MCC/MPC will be installed in a protective conduit buried



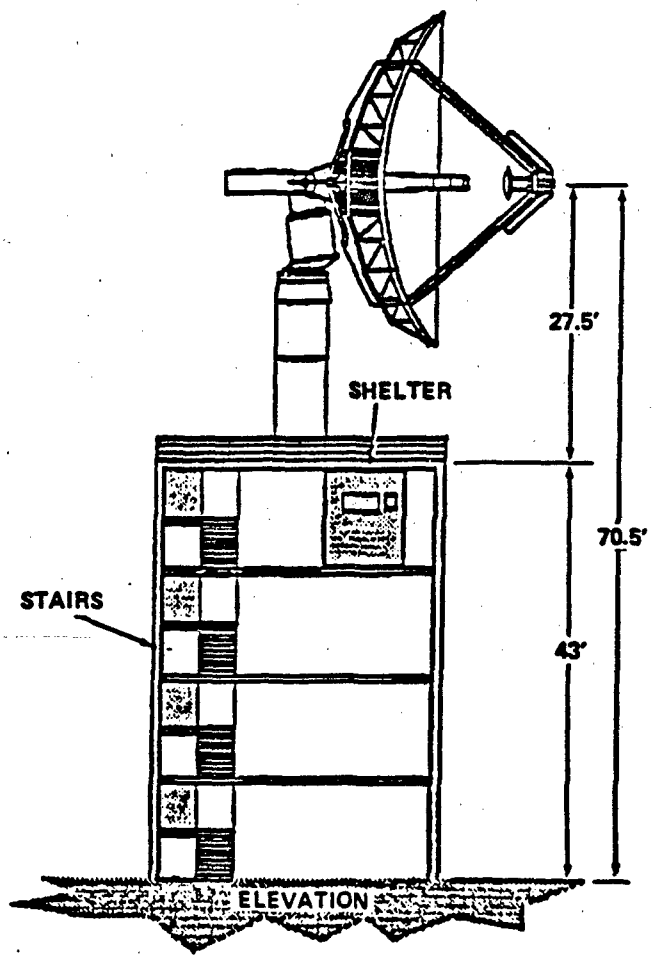
SOURCE: THG, 1991

FIGURE 2-6
JHU/APL SITE MAP

NOT TO SCALE



PLAN VIEW



SOURCE: JHU/AFL

NOT TO SCALE
Note: Dimensions in feet.

FIGURE 2-7
ELEVATION OF MSX RADAR ANTENNA

in a trench between Building 36 and the antenna support structure. Trenching depth for a water utility line will average 3.5 feet under existing grade. Trenching depth for the other types of conduit will average 2 to 3 feet under existing grade.

2.2 NO ACTION ALTERNATIVE

The no action alternative is to not conduct the MSX program and to continue the development of midcourse sensors without the ability of the MSX spacecraft to gather actual flight test data. Mission requirements for midcourse sensors development as described in Section 1 would not be met.

2.3 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

2.3.1 Alternative Launch Locations

The only alternative space center and range in the United States with capabilities to support medium launch vehicles such as the Delta II is Cape Canaveral Air Force Station (CCAFS), Florida. Cape Canaveral has existing facilities to support Delta II; however, it is limited to easterly launch azimuths in order to avoid land overflight (see Figure 2-5). In-flight change to a polar orbit after a CCAFS launch, while technically feasible, would increase the amount of fuel burned, decrease the payload capacity, and increase safety hazards (DOT, 1988). For MSX, the extra fuel expenditure would reduce the maximum orbital altitude to below mission requirements (PRA, 1991b). Vandenberg AFB is the only location with the capability to deliver payloads directly into polar orbit. MSX mission parameters call for a polar orbit in order to observe atmospheric phenomena at various earth latitudes (PRA, 1991b). Vandenberg AFB is located on a headland, extending into the Pacific Ocean; therefore, launches that have southerly launch azimuths (i.e., launches into a polar orbit) do not pass over any major land mass while

the booster is low enough to pose a potential ground safety threat. Also, the Space Shuttle was eliminated because it does not launch into polar orbit from CCAFS.

2.3.2 Alternative Launch Vehicles

Launch vehicles of an appropriate size and having other performance characteristics to boost the nearly 6,000 pound MSX spacecraft into orbit are limited in number, and consist of variants of Delta, Atlas, and Titan rockets: the augmented Titan II, made by Martin Marietta; the Atlas-Centaur, made by General Dynamics; and the Delta II, made by McDonnell Douglas. Small performance differences (predicted performance, in the case of the augmented Titan II) separate these three, but any one would satisfy MSX requirements (PRA, 1991b). Environmental impact differences (air emissions, noise) between the three are also small (PRA, 1992).

The Delta II launch vehicle was chosen over alternative vehicles on the basis of thrust and other performance characteristics, commercial availability, and cost in a competitive procurement. General Dynamics did not submit a proposal in response to the MSX launch vehicle solicitation, thus eliminating the Atlas from consideration. Reliability uncertainties weighed against the Titan II, as the augmented Titan II has not proven itself in a real launch; MSX would be its first. The Delta II has proven its reliability in numerous previous launches (PRA, 1991b; PRA, 1992).

3.0 AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

This section provides a discussion of the environment at locations that will be affected by the proposed action. These locations include those for fabrication, assembly, integration testing, and prelaunch and launch activities for the MSX spacecraft.

Information regarding MSX activity locations was obtained from a site visit to JHU/APL, background questionnaires, telephone interviews, and extracts from existing environmental documentation. The goal was to identify current and proposed activities and the status of environmental compliance at the various facilities. Activities at each facility were reviewed to determine the potential impacts from execution of the proposed activities on the existing characteristics in the following environmental media: physical setting and land use, geology and water resources, air quality, noise, biological resources, threatened and endangered species, cultural resources, aesthetics, infrastructure, hazardous materials and waste, and safety. The description here of the existing environment at each facility is consistent with the level of activity proposed and the potential effect on the environment.

The baseline information on the locations and test activities provides a basis for assessing the significance of potential impacts. Many of the environmental media are regulated by Federal and/or state regulations, which also helped determine the level of significance of impacts.

3.1 FABRICATION, ASSEMBLY, AND INTEGRATION TESTING LOCATIONS

3.1.1 Massachusetts Institute of Technology/Lincoln Laboratory, Lexington, Massachusetts

Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL) was established in 1951 under DOD sponsorship. Lincoln Laboratory is a federally funded Research and Development Center operated by MIT. Its purpose is to perform, analyze, integrate, support, and manage basic and applied research and development in support of National Defense. MIT/LL is located on Hanscom Air Force Base in Lexington, Massachusetts. It employs more than 900 technical staff members (MIT/LL, undated).

Activities to be performed for MSX at MIT/LL (e.g., SBV sensor and reference objects development) are routine procedures and take place within the existing facilities. No construction or additional personnel will be required for MSX-related activities. Lincoln Laboratory is in compliance with environmental requirements and has all required permits. The activities planned for MSX fit within the scope of existing safety plans (MIT/LL, 1991a; MIT/LL, 1991b).

3.1.2 Utah State University/Space Dynamics Laboratory, Logan, Utah

Utah State University/Space Dynamics Laboratory (USU/SDL) has played a key research role in the U.S. Space Program since 1959, and today conducts experimentation and instrumentation for upper atmospheric and space measurements. USU/SDL has instrumented and performed measurements for atmospheric research with sounding rockets, aircraft, and satellites including instrumentation for space shuttle flights and rocketry payloads (USU/SDL, 1991a). Located in Logan Utah, SDL, under the auspices of USU, has a total of 263 employees (USU/SDL, 1991a).

Activities to be performed for MSX at USU/SDL are routine procedures and take place within existing facilities. No construction or additional personnel will be required for MSX activities. USU/SDL is in compliance with environmental requirements and has all required permits. Also, safety plans currently exist for activities planned for MSX (USU/SDL, 1991b).

3.1.3 Johns Hopkins University/Applied Physics Laboratory, Laurel, Maryland

JHU/APL was formed in 1942 and is located in southeastern Howard County. The site is approximately 22 miles from the center of Washington, D.C, halfway between Baltimore and Washington, D.C. JHU/APL has a campus-like setting on 360 acres with over 100 specialty laboratories and other facilities, and numerous radar antennae. JHU/APL currently employs approximately 2,800 people.

The MSX spacecraft will be developed in Buildings 23 and 36, located on the northwest section of the JHU/APL property. The proposed antenna site is immediately next to Building 23 (see Figure 2-6). The site is a flat, grassed area originally graded in 1983 at the time of Building 23 construction. On the north and east sides of the site are laboratory and maintenance buildings. Building 36 and a 60-foot diameter radar antenna are located on the south side of the site. To the west of the site is an antenna range used for calibrating antennas, an interior road, and a parking lot area. Development next to the northwest area of JHU/APL is characterized by large, developed 3-acre lots in a rural residential zone. According to the Howard County General Plan (Howard County, 1991), this area will remain residential at its current density.

Activities to be performed for MSX at JHU/APL are routine procedures and take place within existing facilities. No additional personnel will be required for MSX activities, and safety plans currently exist for activities planned for MSX.

3.2 MSX SPACECRAFT PRELAUNCH AND LAUNCH LOCATION, VANDENBERG AIR FORCE BASE, CALIFORNIA

The prelaunch and launch activities for the MSX satellite will be located at SLC-2W at Vandenberg AFB. SLC-2W will be modified so that both Delta I and Delta II configuration rockets can be launched from Vandenberg AFB. NASA has prepared an environmental assessment, dated September 1991, for the modification and subsequent operation of SLC-2W. The SLC-2W EA discusses the existing environment and significant issues in detail, and has been incorporated in this document by reference. This section summarizes the affected environment section of that document relevant to the preparation of the MSX spacecraft.

Vandenberg AFB occupies 98,400 acres (154 square miles) along the south central coast of California, 140 miles northwest of Los Angeles and about 5 miles west of Lompoc in Santa Barbara County. Vandenberg AFB is bounded by the Pacific Ocean to the west and south. Areas adjoining the north and east boundaries of Vandenberg AFB are used mainly for grazing and intensive agriculture. Offshore uses to the west are mostly oil production and marine activities. Portions of the land on the base are used for agriculture, grazing, hunting, and fishing.

The surface topography of Vandenberg AFB is varied. The highest topographic relief is in the northern and southern parts of the base. The central portion consists of a large mesa, the Burton Mesa. SLC-2W is on the Burton Mesa, between two watercourses, about one mile from the ocean shore near Purisima Point. Sand dunes extend inland from the ocean to the proximity of SLC-2W.

Groundwater in the Vandenberg AFB vicinity is present in four groundwater basins, and groundwater is the sole source of potable water on Vandenberg AFB for approximately 3,401 acre-feet per year of domestic and operational use. Increased withdrawals from the area's

ground water basins for Vandenberg AFB, municipal, and agricultural use have created an overdraft condition that is affecting the availability and quality of water in these basins.

Water quality of surface water near SLC-2W is recognized as poor to medium quality due to the high levels of total dissolved solids, chloride, lead, and zinc. However, ground water quality in the region meets all National Interim Primary Drinking Water Regulations. Inorganic, organic, pesticide, and herbicide constituents parameters are monitored for each of Vandenberg AFB's ground water wells.

Vandenberg AFB is part of the California South Central Coast Basin. Historically recorded data from State and Local Air Monitoring Stations (SLAMS) provided the most accurate air quality data for the SLC-2W launch site area. Up to May 1988, the SLAMS recorded levels of ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_x), particulate matter (less than 10 microns in size) (PM_{10}) and total suspended particulate (TSP). In April 1992, the Watt Road Prevention of Significant Deterioration (PSD) site will begin 12 months of preconstruction monitoring for pollutants. The Watt Road station will become the second PSD site located on Vandenberg AFB (USAF, 1992). These data are published quarterly and summarized annually. In October 1987, the Santa Barbara County Air Pollution Control District (SBCAPCD) suggested that North Santa Barbara County be redesignated as a nonattainment area for ozone because national ambient air quality standards (NAAQS) were exceeded. Also, the SBCAPCD considers the area in nonattainment of State particulate matter standards and regulates this pollutant and its precursor, sulfur oxides (SO_x).

The SLC-2W facility is relatively isolated from civilian residential areas. Ambient noise levels at Vandenberg AFB are generally low. The primary sources of noise at Vandenberg AFB are from the following: aircraft takeoffs and landings, rocket launches, railroad traffic, and automobile and truck traffic.

Vegetation within the boundaries of the SLC-2W facility is very sparse and is characteristic of a coastal dune scrub community. This community is dominated by a dense cover of shrubs three to seven feet high. Native shrubs include mock heather, dune lupine, California sage brush, deerweed, and dune mint. Vegetation within the facility boundary is very sparse. Introduced species, such as ice plant, mission veldt grass, and pampas grass, are dominant in areas not covered by structures or paving.

Herbaceous vegetation of concern known to occur in the coastal dune habitat include: dune mint, soft leaved indian paint brush, LaGraciosa thistle, surf thistle, and coast spectacle pod. The dune mint, soft leaved indian paint brush, and coast spectacle pod are Federal Category 2 species. The LaGraciosa thistle is a threatened Federal Category species, and surf thistle is listed by California as threatened. The surf thistle and coast spectacle pod are known to occur within the SLC-2W area.

In the vicinity of SLC-2W, wildlife is sparse due to the long history of disturbance, the lack of cover, and the absence of fresh water, as well as the current presence of humans and facilities. The western fence lizard and the western gull have been observed within the project area. However, the western fence lizard is rather widespread, and the Western gull may be found in any coastal area of California.

Four federally listed endangered or threatened wildlife species known to occur on Vandenberg AFB include the Unarmored Threespine Stickleback, the California Brown Pelican, the California Least Tern, and the California Sea Otter. The Western Snowy Plover, a Federal Category 1 Species, is also known to frequent the area. The Honda, San Antonio Creeks, the mouth of the Santa Ynez River, the dunes at Purisima Point, and Vandenberg AFB coastline provide habitat for these species. Only the California Least Tern was at issue for impacts from the launch of the Delta II in the SLC-2W EA.

The California Least Tern has been known to nest at Purisima Point (approximately 2,200 feet form SLC-2W) from approximately April through August. A monitoring program in effect since 1980 has observed a high of 30 nesting pairs in 1980 and a low of zero nesting pairs in 1986. The program counted 14 breeding pairs in 1987 and 9 pairs in 1990.

The area is rich in prehistoric, historic, and cultural resources, and there are cultural resources in the immediate vicinity of SLC-2W. A cultural resources identification survey is being conducted in accordance with Section 106 of the National Historic Preservation Act. Limiting access to the area also contributes to the preservation of known and unknown prehistoric, historic, and cultural resources.

Vandenberg AFB's economic impact region consists of the area generally within a 50-mile radius of the Base and includes most of Santa Barbara and San Luis Obispo Counties. Vandenberg AFB is a major economic force, estimated to provide about two-thirds of the local job opportunities. Employment at Vandenberg AFB, however, has decreased from approximately 16,000 in 1985 to about 11,000 at the present time.

Energy for the Vandenberg AFB region is supplied by electric power from the Pacific Gas and Electric Company. Government electric energy generating capacity is controlled by the U.S. Air Force and additional power is available from commercial sources.

Propellants are routinely recycled from overflow lines and waste propellant is typically not generated by SLC-2W launches. In order to reduce hazardous waste during Delta II fueling, deionized water rather than freon will be used to flush the nitrogen tetroxide (N_2O_4) system. The aerozine-50 system uses a scrubber water catch tank, rather than an open pond. Deluge water is captured in a newly-sealed collection pond. In addition, the water flow on the deluge system was recently adjusted to reduce the amount of wastewater produced.

With respect to all activities related to rocket launches and fuel handling and storage, Vandenberg AFB complies with the military System Safety Program Plan, which assures compliance with Federal, State, and Air Force Occupational Safety zones and explosives. A safety review will be conducted for each program (including MSX) and documented in an Accident Risk Assessment Report. This report will assess the launch vehicle, the payload, support equipment, and facilities. A range safety certification must be completed six months before the launch.

4.0 ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

The significance of potential impacts that may result from MSX activities to each of the environmental media was assessed by analyzing the description of the proposed activities and alternatives (DOPAA) (Section 2.0) with respect to the environmental setting at each participating installation (Section 3.0). Environmental media evaluated include: physical setting and land use, geology and water resources, air quality, noise, biological resources, threatened and endangered species, cultural resources, infrastructure, hazardous materials and waste, and public health and safety.

Each phase of the MSX program was examined to determine whether the potential existed for environmental impact. These phases were then evaluated in terms of each site and medium to determine if: 1) an impact could potentially occur, and 2) if the impact would be significant. The criteria for assessing impact significance vary according to the medium under consideration. Specific Federal or state standards are applicable to certain media; those standards provide the measure of "significance." For those media in which standards are not applicable, impacts were measured against the percentage reduction in availability of the resource (for either humans or flora and fauna) against the overall resource availability. Where a potentially significant impact has been identified, appropriate mitigation measures will be adopted to reduce impacts to nonsignificant levels.

Section 4.1 of this EA describes the environmental consequences of the fabrication, assembly, and integration testing at MIT/LL, USU/SDL, and JHU/APL. Section 4.2 describes the environmental impacts at the MSX satellite prelaunch and launch location, Vandenberg AFB. MSX satellite operations in space are discussed in Section 4.3. Section 4.4 describes potential cumulative impacts. Impacts from the no action alternative are described in Section 4.5.

4.1 FABRICATION, ASSEMBLY, AND INTEGRATION TESTING LOCATIONS

The purpose of this section is to determine whether the MSX activities will cause significant (adverse or beneficial) impact to the existing environment at specific geographic locations. Only unique environmental issues from MSX-specific activities at fabrication, assembly, and integration testing locations are additions to the existing baseline at the locations are discussed.

4.1.1 Massachusetts Institute of Technology/Lincoln Laboratory, Lexington, Massachusetts

MIT/LL is responsible for providing the SBV sensor and Reference Objects. These activities are within the normal scope of operations routinely conducted at MIT/LL. The activities will take place at existing facilities. No additional personnel or facilities will be required. No significant project-specific or cumulative environmental impacts are expected as a result of MSX activities at MIT/LL.

4.1.2 Utah State University/Space Dynamics Laboratory, Logan, Utah

USU/SDL is responsible for developing and fabricating the SPIRIT III sensor and ground support and calibration equipment. These activities are within the normal scope of operations routinely conducted at USU/SDL. The activities will take place in existing facilities and no construction is anticipated. Although additional personnel will be hired, the number will be fewer than ten. No significant project-specific or cumulative environmental impacts are expected as a result of MSX activities at USU/SDL.

4.1.3 Johns Hopkins University/Applied Physics Laboratory, Laurel, Maryland

JHU/APL is responsible for the following activities: satellite support instrumentation development; UVISI sensor development; the contamination experiment development; and satellite systems integration and testing. These activities fit within the scope of the activities routinely conducted at JHU/APL. No additional personnel will be necessary.

The satellite communications facility at JHU/APL will be upgraded to include a ten-meter parabolic antenna and antenna support structure. A small area will be trenched for utility lines and a 40-foot by 40-foot area will be developed for a concrete pad to support the radar tower. The antenna support structure site and the cable trench areas are flat, grassed areas originally graded at the time of the construction of Building 23 (see Figure 2-6 for JHU/APL site map). Potential for significant environmental impacts to land use, visual resources, and public health and safety was identified. The potential impacts resulting form the proposed action have been assessed relative to these environmental media.

Potential for significant environmental impacts to other environmental media, (i.e., water resources, soils, biological and cultural resources) is low because of the minor extent of grading involved and prior disturbance in 1983. Impacts to air quality and noise levels will be minimal, and occur during construction.

Proposed construction of the antenna support structure will have the potential to affect land use through its location and its height at the JHU/APL site. Installation approval has been granted by JHU/APL for project construction. The site plan for installation and operation of the antenna and its supporting structure has been approved by Howard County, Maryland, and full county approval of the antenna support structure is expected upon submittal of construction drawings. No problems with local permitting process have been

encountered or are anticipated. Because of the installation approval and County permitting process, no significant impact to land use is foreseen.

Antenna structures are located throughout the JHU/APL complex, and are part of the general land use of the area. For example, approximately 500 feet south of the proposed installation site is a 60-foot diameter antenna (see Figure 2-6). The proposed antenna's location next to Building 23 will reduce the visual impact of the structure because of the mass and height of Building 23. The equipment shelter, located on the support structure, will be built to blend with the exterior of the adjacent building. Also, the site is partly screened from adjacent public roads by evergreen trees.

A site analysis of six sites was conducted in choosing the site adjacent to Building 23. Criteria were view adequacy (for the radar), Building 36 interface, radiation hazard minimization, visual screening, and safety. Given existing radar antennas at JHU/APL, existing vegetation screening, and the location of the structure immediately adjacent to Building 23, significant impacts to visual resources are not anticipated.

Impacts to public health and safety may occur as a result of the electromagnetic radiation emitted from the antenna during use. JHU/APL will uplink commands to the satellite and will be the primary ground site to which data will be downlinked. Radiation from radar antennas may cause thermal and photochemical damage to the eye and skin. The JHU/APL operating standard requires that personnel not experience a power density greater than 0.1 milliwatts per square centimeter (mW/cm^2). This standard is much more strict than the American National Standard Institute's (ANSI) C95.1-1982 standard of 5 mW/cm^2.

Without controls, the JHU/APL and ANSI standards for personnel would be exceeded by the main beam within 5,717 feet of the antenna, where a maximum of 8.4 mW/cm^2 will

occur. In addition, spillover radiation will exceed the JHU/APL limit within 155 feet of the feed horn. This area includes the antenna deck and portions of the Building 23 roof. To prevent personnel from being exposed to radiation levels above the JHU/APL limit, the antenna will include a programmable horizon lockout (i.e., control of the beam angle relative to the horizon), and the support structure will include an audible warning to personnel on the antenna deck and on the Building 23 roof. In addition, a postinstallation survey will be performed to determine the power density levels in Building 23 and other possible personnel locations. If levels are above the JHU/APL limit, then levels will be reduced by shielding and antenna lockout adjustments. Because of the measures listed above, it is not expected that workers or the public would be exposed to power densities above 0.1 mW/cm^2. Therefore, impacts to public health and safety will be not significant. No significant project-specific or cumulative environmental impacts are expected as a result of MSX activities at JHU/APL.

4.2 MSX SPACECRAFT PRELAUNCH AND LAUNCH LOCATION, VANDENBERG AIR FORCE BASE, CALIFORNIA

The Environmental Assessment for the Modification of Space Launch Complex-2W (NASA, 1991) is incorporated in this document by reference in accordance with Council on Environmental Quality regulations (40 CFR 1502.21). All MSX program activities related to the assembly and launch of the Delta II rocket will operate within the SLC-2W Finding of No Significant Impact and conform to the mitigation measures contained therein.

This section discusses issues unique to the MSX spacecraft and addresses any potential impacts and required mitigation specific to the MSX program. A brief review of the critical issues identified in the SLC-2W EA is also provided for completeness.

Potential environmental effects on water quality from the launch of a Delta II include: contamination of geology and water resources from deluge water; launch pad accidents and propellant spills; contamination of surface waters from exhaust-cloud deposition of HCl and Al_2O_3; and flight failure that may result in propellants falling into the ocean or nearby surface waters. The deluge, fire suppressant, and/or postlaunch washdown water will be collected in a sealed catchment basins. The water will be analyzed to determine how it will be discharged; i.e., to grade, to the base treatment plant, or to a hazardous waste facility. Accidental releases of small quantities of fuel and propellants may occur at the launch pad. Such spills, however, are designed to be retained in the impervious holding areas surrounding the fuel and propellant supply tanks. HCl deposited in surrounding surface waters because of the launch of the Delta II rocket and its subsequent ground cloud will be rapidly neutralized by the extensive buffering capacity of the ocean. Al_2O_3 deposited in surface waters will remain insoluble and will not be toxic to aquatic life. No significant impacts to ground water or surface water are expected as a result of the MSX Delta II launch. Potential Delta II impacts on water quality are not anticipated to be exacerbated by the MSX spacecraft payload. No liquids are aboard the spacecraft, and no releases from surface or ground water will occur from the payload during a normal launch. Contamination from a fire or other launch accident would result mainly from the Delta II booster and not from the MSX payload.

Potential air pollutant emissions at Vandenberg AFB due to the launch of a Delta II spacecraft include: chemical releases during fueling and prelaunch testing and launch emissions during liftoff. The release of fuels during ground operations will be controlled by scrubber systems, roof vents, air handlers, and recovery systems. The only Delta II launch emission that presents an environmental concern at ground level is HCl. This emission will be limited to a small area, will be of short duration, will be confined to restricted areas already historically exposed to HCl, and will not exacerbate existing

conditions. Significant impacts to air quality from the prelaunch and launch of a Delta II are not expected.

Vapors from cryogenic liquids on the MSX spacecraft payload will be released to the atmosphere during prelaunch maintenance. Minor venting of the hydrogen and argon cryogens will also occur during launch. Impacts from these emissions will be minimal.

The SLC-2W pad and payload processing facilities have permits that control and limit atmospheric releases during operations. These permits were modified slightly to accommodate Delta II launches. The MSX spacecraft operations will not exceed the existing permits for SLC-2W (USAF, 1991).

Noise impacts to the Least Tern, whose breeding grounds are located approximately 2,200 feet from SLC-2W, will not be significant because Delta II launches (including the MSX Delta II launch) will not occur during the breeding season. In addition, NASA will monitor noise levels at Purisima Point during Delta II launches. Delta II noise levels will be unaffected by the MSX payload.

Potential impacts to the environment due to hazardous materials could occur due to the presence of the liquid Delta II rocket propellants (RP-1 [a type of kerosene], liquid oxygen, Aerozine-50, and nitrogen tetroxide), MSX payload cryogenics, and cleaning solvents used for booster and payload preparation. The MSX payload has no rocket propellants aboard. In the event of a cryogen spill, the liquid hydrogen and argon would quickly gassify, and dissipate into the atmosphere. Other wastes that could be generated during prelaunch activities include: solvents, adhesives, alcohol, lubricant, oil, grease, fuel, small quantities of propellant, contaminated rags or cotton swabs, and process chemicals. MSX payload preparation would generate minor quantities of hazardous wastes similar to those produced by Delta II preparation activities. All hazardous wastes will be handled by a licensed

hazardous waste disposal facility in accordance with the Hazardous Waste Source Reduction and Management Review Act of 1989 (NASA, 1991).

Potential impacts to public health and safety may occur as a result of launching the MSX spacecraft on the Delta II launch vehicle. The assembly and fueling of the Delta II rocket will be conducted in accordance with activity-specific standard operating procedures that will be developed for this launch and will integrate procedures for the rocket and MSX payload. In the event of a spill, clean-up procedures will be conducted in accordance with the emergency contingency plan developed by the USAF 30SPW and the Spill Prevention Control and Countermeasure Plan which integrates base plans for emergency response.

Safety requirements at Vandenberg AFB will ensure that all workers and the public remain outside of established safety zones. Explosive safety quantity distances (ESQDs) will be established around storage areas and the launch pad. The public and any observers of the launch will be outside of the ground hazard area (GHA) established for this launch. Such safety areas are designed to minimize impacts to operations personnel and the public from potentially damaging noise, air emissions, or debris in the event of a failure. Personnel within the safety area will wear personal protective equipment or remain within the launch operations control building. In addition, the closest uncontrolled area (i.e., public area) from SLC-2W is approximately 5.5 miles away. Because the MSX ESQD and GHA will be unchanged from those for the Delta II alone, there would not be a significant impact to the public as a result of the launching of the MSX spacecraft.

Range safety at Vandenberg has the capability to activate the launch vehicle's self-destruct system until the vehicle is even with the northern Mexico latitudes. Advanced notice will be given to ships, oil platforms, and others along the booster's flight path so that personnel may be cleared from these areas during the launch. Airborne observers will follow the flight path immediately following lift-off to verify that the spent booster stages fall into the ocean.

Although analysis has not been completed specifically for the MSX launch, previous analyses completed for similar flights have shown that the launch vehicle and spacecraft will land on the Antarctic continent if they fall into a suborbital flight path (PRA, 1991b).

The potential safety hazards from the MSX payload are as follows: the radioactive Ni^{63} isotope carried in the krypton flashlamp; the pyrotechnic separation nuts; and the hydrogen-filled cryostat (PRA, 1991b). The amount of Ni^{63} isotope required for the krypton flashlamp will not be harmful to personnel (JHU/APL, 1991a). The level of radiation that will be emitted is expected to be 80 microcuries (μCi). Because this level is below the threshold of 100 μCi, licensing and stringent control procedures and documentation will not be required. In addition, standard operating procedures will be developed in a Safety Analysis Summary and implemented by JHU/APL. No significant impacts to public health and safety will occur as a result of the Ni^{63} in the flashlamp.

Pyrotechnic separation nuts with a small amount of explosive material will be used to separate the spacecraft from the launch vehicle. The hazard they present is the danger of exploding during the prelaunch and launch activities. Standard safety operating procedures concerning the use of the separation nuts will be developed and implemented prior to any payload processing activities or launch operations. No significant impacts to public health and safety will occur as a result of the separation nuts.

The hydrogen-filled dewar for the SPIRIT III sensor will contain 172 pounds of solid hydrogen. Hydrogen is an explosive substance and an asphyxiant. Chemical sensors tuned to hydrogen gas will be placed in key locations at the Payload Processing Facility (Building 1610). Any detected hydrogen leaks will be vented to the atmosphere where the gas will disperse without harm to the workers or the environment. Significant impacts due to the use of hydrogen cryogen are not anticipated.

4.3 MSX SPACECRAFT OPERATIONS

4.3.1 Spacecraft Operation

The MSX spacecraft will impact the natural space environment in which it operates, and it has the potential to interfere with other satellites or to have impacts on the ground in the United States. In the space environment, venting of 172 pounds of hydrogen from the SPIRIT III dewar and 15 liters of argon from the SPIRIT III lens cover dewar over the approximately two-year lifetime of SPIRIT III will occur in a near-uniform distribution over the earth at the MSX orbit altitude of 888 km. These releases will result in a broad distribution of the gases at very low concentrations. Because the small quantities of these releases, no significant impacts to ion concentrations in the ionosphere are expected. Both hydrogen and argon are atmospheric trace gases, and atomic hydrogen is a predominate atmospheric constituent at the release altitude. On-orbit releases will also have no impact on the ozone layer (the majority of which is located in the stratosphere between 10 and 50 kilometer altitudes) since these chemicals are not significant ozone-depleting compounds and diffusion will disperse the releases before an impact could occur within the lower atmosphere. No significant impacts will occur from these releases.

Potential interference with other satellites is possible whenever an object is placed into orbit. Interference would most likely occur as a collision, however; the probability is remote. Orbits utilized by existing satellites are currently monitored and would, therefore, be avoided by MSX. Although the Low Earth Orbit (LEO) region contains the largest spatial density (number/cubic kilometer) of space objects (which includes orbital debris), the probability of collision with other objects would be small. Only a very small percentage of these objects are active satellites. The majority of collision risk is with smaller orbital debris (objects in the order of 10-centimeter cross section). Collision times between LEO

debris and a satellite of 5-square-meter cross section on an orbit comparable to MSX is estimated to be in the order of once in every 480,000 years (USDOT, 1988).

The potential for electromagnetic interference with other satellites is also insignificant. The MSX satellite will only contain a very small amount of radioactive material (in the krypton flashlamp discussed in Section 4.2) and will use assigned radio frequencies, thereby minimizing possible electromagnetic interference.

On orbit operation of the SPIRIT III, mirror cleaner will not have significant impacts on other spacecraft or sensors or at the earth's surface (USU/SDL, 1992). The focus assembly for the laser to be used for mirror cleaning employs a negative lens; laser radiation will diverge at the output of the lens, and output intensity will dissipate rapidly to insignificant levels within a short distance from the spacecraft. For example, average output density at the 1-centimeter diameter aperture of the 285 mJ laser will be 0.726 watts per square centimeter (W/cm^2), and instantaneous peak intensity will be 9.07×10^4 W/cm^2. By 1 kilometer from the spacecraft, the beam diameter will diverge to 112 meters, and intensity of the beam will decrease by a factor of over 100,000,000. Further dissipation of laser energy will occur between the 888-km orbit of the spacecraft and the earth's surface.

Interactions with the ground that could result in potentially significant impacts are the spacecraft command and control operations and data downlink. These activities will be accomplished using facilities at JHU/APL, CSTC, and other existing satellite tracking stations, using assigned radio frequencies. These operations are only hazardous near their source due to the broadening of the radio beam with distance. In the case of ground stations, sources are monitored and controlled as described in Section 2.1.6. Focused energy beams that can have ground impacts, such as lasers, will not be used for MSX command and control or data transmission.

4.3.2 Target Releases

Target releases from dedicated MSX target flights may include aeroshells, lightweight replicas, instrumented balloons, emissive and reflective reference spheres, chaff, debris fragments, and unburned hydrazine fuel. With the exception of the hydrazine fuel, released objects are expected to have size, weight, and compositions similar to satellites, boosters, and payloads that are routinely placed in suborbital trajectories. The target flight profiles for STARS-launched targets from KTF and MMI-launched targets from Vandenberg AFB have been designed to minimize the risk from land impact of launch debris by using ocean flight trajectories. Deorbiting objects typically break up on reentry, and often vaporize before impacting the earth because of intense aerodynamic heating. Quantities of exotic or toxic materials incorporated in the targets are small, and will be widely dispersed to concentrations within the range of background levels should the vehicle break up and portions vaporize prior to impacting the earth. Impacts from target releases will be not significant because of the negligible likelihood of land impact.

The present proposal for release of 2 canisters approximately 57 pounds each of unburned UDMH fuel at earth altitudes of 300 km and 1,000 km is identical with that assessed in the STARS EA (USASDC, 1990a), where it was found to be not significant. The *Chemical Release Experiment Environmental Assessment* (USAF, 1987) assessed releases of about 100 pounds of hydrazine (several types were assessed, including UDMH) at an earth altitude of 300 km. This report determined the most likely impact to be a localized disturbance (within the near vicinity of the release) to ion concentrations. This disturbance could have an effect on telecommunications or astronomy observations within this limited region; however, these effects are expected to be very transient (on the order of a minute) and not significant. The released fuel would be dispersed (and thus diluted) over the vehicle's flight path and quickly dissipated by the intense ultraviolet radiation and ions present at these altitudes. No significant impacts in space are expected from the MSX fuel vent experiment.

4.3.3 Spacecraft Deorbit

All objects placed in earth orbit have the potential to deorbit and reenter the atmosphere. An estimated 500 objects and thousands of debris fragments reenter each year; however, few survive reentry. Unless specialized protection is provided, most objects will break up and often vaporize under the intense aerodynamic forces and heating that occur during reentry. Roughly 100 of the approximately 3,100 objects resulting from 44 launches between 1956 to 1972 have survived reentry and were recovered (USDOT, 1988). No casualties or injuries are known to have resulted from such surviving fragments, thus, the hazard from reentry debris is considered small (USDOT, 1986).

The MSX spacecraft is not expected to deorbit for 300 to 1,000 years (PRA, 1992). Program plans for MSX and other United States satellites do not include deorbit or orbital transfer plans or capability. Consolidated Space Test Center (CSTC) deorbit planning does not include satellites with an expected orbital lifetime of greater than 10 years in its current deorbit planning. However, CSTC will track MSX and identify when orbit degeneration occurs. Predictions can then be made as to when and where debris impacts could occur.

Designs for the MSX spacecraft have minimized the amounts of hazardous materials carried aboard. Expendables such as cryogens are expected to be consumed at the end of the MSX mission. Most of the spacecraft is expected to break up and burn up during reentry, which will disseminate any remaining hazardous materials over a wide area. The small amount of low level Ni^{63} radioactive element aboard, should it survive intact, and be found by a person, is insufficient to cause significant health effects (JHU/APL, 1991b).

Fragments of the spacecraft that remain intact have a very low likelihood of causing casualties. Considering that 70 percent of the earth's surface is covered by water and, of the remaining 30 percent of land mass, approximately one quarter is moderately to densely

populated, the chances of a populated area being hit upon reentry of space debris is much smaller than the chances of being hit by one of the 500 meteorites that strike the earth each year (OTA, 1990).

4.4 CUMULATIVE IMPACTS

Ground activities at fabrication, assembly, and integration testing locations are routine operations for each location. Compliance with applicable regulations will ensure that MSX activities will not contribute to cumulative environmental effects at these facilities. The spacecraft prelaunch activities will be conducted in existing facilities and will be within the scope of the activities routinely conducted at those facilities. The Delta II launch for the MSX spacecraft is one of a planned series of launches for which potential cumulative impacts have been addressed and found to be not significant. MSX spacecraft handling and launch activities will not contribute to cumulative environmental effects at Vandenberg AFB. Use of boosters for MSX dedicated target launches that have been assessed programmatically for cumulative impacts will ensure that MSX target launches do not contribute to cumulative environmental effects at launch and range locations.

4.5 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

The no action alternative is to not conduct the MSX experiment as presently planned. Fabrication, assembly, and integration tests are routine operations with no identifiable impacts at the indicated facilities; it is reasonable to expect that other, similar types of operations would be conducted in the absence of the MSX program with the same lack of impacts.

The MSX satellite launch activities proposed for Vandenberg AFB are similar to ongoing operations at the facility. As detailed in the preceding sections, environmental impacts from

the MSX program are low, with no significant impacts. Elimination of the single proposed MSX Delta II launch would result in the booster being reassigned to another program. Therefore, the environmental impacts at Vandenberg AFB from the no action alternative are not expected to differ significantly from those expected to result from the MSX program.

Dedicated target flights on STARS and MMI are using rockets that serve (or are planned to serve) many DOD programs. It is likely that the up to four STARS and MMI rockets planned for use on MSX would be utilized for other programs. Impacts from the no action alternative on target launches are not expected to differ significantly from those identified with the MSX program.

5.0 AGENCIES AND PERSONS CONSULTED

5.0 AGENCIES AND PERSONS CONSULTED

Harry Aimes/Paul Huber
Utah State University/Space Dynamics Laboratory

Gary Geist/Chris Soberg
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John Kelly
Zoning Administration and Enforcement
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Mike Maddox
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NASA/KSC-V Facilities Manager

Max Peterson/Thomas Pardoe
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Charles Wilson/Joseph Chow
Massachusetts Institute of Technology/Lincoln Laboratory

6.0 REFERENCES

6.0 REFERENCES

Congress of the United States Office of Technology Assessment, 1990. *Orbiting Debris - A Space Environmental Problem* Background Paper.

Howard County Zoning Administration and Enforcement Division, 1991. Personal communication from Mr. John Kelly to Virginia Hayes, DMSS.

The Johns Hopkins University, Applied Physics Laboratory, SDO 9334, (JHU/APL), 1990. *Spacecraft/Ground Network Description, Midcourse Space Experiment (MSX) Program* (July).

The Johns Hopkins University, Applied Physics Laboratory, 1991a. Memorandum from J. McDevitt to J. Lesho regarding Visidyne Proposal to include Radioactive Material in the Krypton Lamp (April).

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Massachusetts Institute of Technology, Lincoln Laboratory, (MIT/LL), 1991b. *Environmental Background Contact Sheet*, April. Personal communication from Dr. Joseph C. Chow to Virginia Hayes, DMSS.

Massachusetts Institute of Technology, Lincoln Laboratory, (MIT/LL), Undated. *Technology Research Areas* (Brochure).

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Photon Research Associates, Inc. (PRA), 1991b. Memo from Chris Soberg to Major Eric Imker, SDIO/TNS, regarding SDIO/TNE data request.

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U.S. Air Force (USAF), 1991. Letter from 30th Space Wing, Vandenberg AFB to NASA regarding air permits requirements for the MSX spacecraft (25 November).

U.S. Air Force (USAF), 1992. *Comments on 28 October 1991 Internal Review Copy of MSX Preliminary Final Environmental Assessment* (February).

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U.S. Department of Transportation (DOT), 1988. *Hazard Analysis of Commercial Space Transportation* (May).

Utah State University, Space Dynamics Laboratory, (USU/SDL), 1991a. *Environmental Background Contact Sheet*, April. Personal communication from Paul E. Huber, to Virginia Hayes, DMSS.

Utah State University, Space Dynamics Laboratory, (USU/SDL), 1991b. *An Overview of Space and Atmospheric Research at Space Dynamics Laboratory USU* (May).

Utah State University, Space Dynamics Laboratory, (USU/SDL), 1992. Personal communication from Gina Wickwar to Virginia Hayes, DMSS, concerning SPIRIT III mirror cleaner operation (February).

7.0 LIST OF PREPARERS

7.0 LIST OF PREPARERS

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Technical Review

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Contribution: Technical Analysis/
Sections 3.0 and 4.0

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APPENDIX A
ENVIRONMENTAL BACKGROUND CONTACT SHEET

ENVIRONMENTAL BACKGROUND CONTACT SHEET

By _____
Date _____

ORGANIZATION _____
POC (Name) _____
(Title) _____

PHONE _____

FAX _____

1. What activities will you perform in support of the MSX Program?

2. Are these activities along the lines of regular activities that you perform in terms of scope and size? Can we assume that you are dealing with proven technology?

3. Where on your facility will testing take place? (area, building #s)

Is that area particularly degraded or pristine or neither? are the proposed activities expected to be environmentally controversial?

Have any of the following issues been identified as areas of possible concern?

- threatened or endangered species?
- archeological remains or historic sites?
- prime or unique agricultural land?
- wetlands?
- coastal zone?
- wilderness areas?

- aquifers?
- floodplain?
- wild and scenic rivers?
- superfund sites or other areas of known contamination?

4. Will this undertaking (i.e., fabrication, testing) entail new construction?

5. Will the project require the hiring of additional staff?

6. Please give a brief overview of your time table? (deliverables, major milestones)

7. Whether or not a similar activity has been done in the past, is there any environmental documentation geared towards this project in particular or any similar project which was undertaken in the past by your organization? Also, has any environmental documentation been done as part of your permitting process?

8. If no specific environmental documentation exists (i.e., if #7 is a no), is there some baseline environmental documentation which has been published that you know of which covers similar activities?

9. What are the Federal and state and local environmental permits required to operate the specific facilities that will be employed to perform the proposed activities? Will any new permits from any of the three be required? If yes, what. Is this for construction?

10. If the operations are new to the facility, is there a safety plan proposed? Is it available?

11. What are the transport methods, if any, that are necessary for shipments associated with the proposed activities? Is this routine or not? If not, is there a safety plan/ or what is the safety plan?

12. Will any facilities be decommissioned following the proposed activities?

ENVIRONMENTAL BACKGROUND CONTACT SHEET

Data Gathering Protocol

The protocol includes a review and analysis of potential environmental effects for each of the primary participants and key test locations in the MSX program. Emphasis is placed on those locations where integration and testing activities that are of a non-routine nature or are specific/unique to SDIO are planned. For planning purposes, the list includes Government laboratories and ranges and primary contractors for components. Should initial contacts disclose potentially significant environmental effects may occur at a particular second-tier contractor, the review/analysis is extended to that contractor.

The process begins with telephone contacts to the points of contact identified, to confirm the roles and relationships involved. Once the initial contact has been made, a list of questions specific to the organization is developed and forwarded to the POC, together with a general questionnaire. The following contact sheet language for labs and contractors that are supporting SDI activities, to be filled out by the POC, in addition to the specific questions.

APPENDIX B
DISTRIBUTION LIST

MSX DISTRIBUTION LIST

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Massachusetts Institute of Technology
Lincoln Laboratory
Space Based Surveillance
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244 Wood Street
Lexington, MA 02173-9108
Attention: Dr. Joseph C. Chow

Massachusetts Institute of Technology
Lincoln Laboratory
Aerospace Engineering
Group 73
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Attention: Charles Wilson

Utah State University/Space Dynamics Laboratory
1787 N. Research Parkway
Logan, Utah 84321
Attention: Harry O. Aimes

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Washington, DC 20301-7100

SDIO/GC
The Pentagon, Rm. 1E1080
Washington, DC 20301-7100

SDIO/IEA
The Pentagon, Rm. 1E1008
Washington, DC 20301-7100

SDIO/SIS
The Pentagon, Rm. 1E1054
Washington, DC 20301-7100

SDIO Technical Information Center (TIC)
Dynamics Research Corp.
1755 Jefferson Davis Hwy., Suite 802
Arlington, VA 22202

SDIO/TNE
The Pentagon, Rm. 1E180
Washington, DC 20301-7100

SDIO/TNS
The Pentagon, Rm. 1E168
Washington, DC 20301-7100
Attention: Col John Mill

USAF/AFSPACECOM/DEPV
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Attention: Joe Correale

USAF/CEVP
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Washington, DC 20301-7100
Attention: John Babicz

USAF, HQ/SSD/DEV
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P.O. Box 92960
Los Angeles AFB, CA 90009-2960
Attention: John Edwards

USAF/30SPW/XPR
Center Planning Manager
Plans, Program, Requirements Directorate
Vandenberg AFB, CA 93437-5000
Attention: Mr. Paul Klock

USASDC
106 Wynn drive
Huntsville, AL 35807
Attention: Mr. Dru Barrineau

FEDERAL AGENCIES

Department of Commerce, National Oceanic and Atmospheric Administration

National Marine Fisheries Service
Washington, DC 20230

National Marine Fisheries Service
Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

Department of the Interior

National Park Service
Channel Islands National Monument
Ventura, CA 93003

U.S. Fish and Wildlife Service
Sacramento Endangered Species Office
Sacramento, CA 95825

National Aeronautics and Space Administration

John F. Kennedy Space Center
MD-RCP
John F. Kennedy Center, FL 32899

Lyndon B. Johnson Space Center
Environmental Effects Project Office
Houston, TX 77058

National Aeronautics and Space Administration
Facilities Utilization, Maintenence
& Environmental Compliance Division
NASA HQ CODE NXG, Rm. 5031
400 Maryland Ave., S.W.
Washington, D.C. 20546
Attention: Joyce Jatcko; Ken Kumar

National Aeronautics and Space Administration
GSFC-DELTA/OLS West Coast Office
McDonnell Douglas Space Systems Company
MS 12-3, OLS Project
5301 Bolsa Ave.
Huntington Beach, CA 92647
Attention: Thomas H. LaVelle

STATE/REGIONAL AGENCIES

California Coastal Commission
631 Howard Street
San Francisco, CA 94105

Other

Photon Research Associates, Inc.
Washington Division
1911 N. Fort Myer Drive, Suite 408
Arlington, VA 22209
Attention: Gary Geist

California Department of Fish and Game
1415 Ninth street
Sacramento, CA 95814

California State Historic Preservation Office
P.O. Box 2390
Sacramento, CA 95811

MIDCOURSE SPACE EXPERIMENT (MSX)

COMMENT RESPONSE REPORT

STRATEGIC DEFENSE
INITIATIVE ORGANIZATION

6 March 1992

COMMENT RESPONSE REPORT (CRR)
MIDCOURSE SPACE EXPERIMENT (MSX)
ENVIRONMENTAL ASSESSMENT (EA)

The purpose of this report is to explain to the MSX reviewers 1) what the major differences in content and format are between the Draft EA (DEA), preliminary final EA (PFEA), and final EA (FEA); and 2) how their comments regarding the DEA and PFEA were addressed in the FEA.

DEA COMMENTS

Many commentors raised concerns that included: treatment in the August 9, 1991 DEA regarding the relationship between MSX and SDI; the level of detail in the DOPAA; the quantity of extraneous information not relevant to environmental impacts; and the proposed construction at JHU/APL. As result of those concerns the following revisions were made:

- The technical detail in the Description of Proposed Action and Alternatives (DOPAA) was streamlined for the PFEA to present only the information that has a direct linkage to the environmental impacts.
- A description of the proposed construction required for an antenna and antenna support structure was included in the DOPAA and an analysis of the potential impacts was included in the environmental consequences chapter.

The discussion of target launches, differentiation between dedicated, nondedicated, and targets of opportunity, and the relationship between MSX, EDX and STARS appeared to become cumbersome and confusing to the reader. This conclusion was drawn from the number of comments received on those sections of the DEA. As a result of these comments the following revisions were made:

- The MSX target sections (i.e. EDX, STARS, etc.) of the baseline and environmental consequences chapters of the DEA were eliminated. The discussion in the DOPAA was scaled back to include brief descriptions of the dedicated and nondedicated targets and the environmental documentation that covers those targets.

Initial concentration on the Delta II launches from Vandenberg AFB was very detailed because the status of NASA's SLC-2W EA was not known and it was uncertain that SDIO would be able to incorporate the document by reference. As it became apparent that the SLC-2W EA would be finalized prior to the MSX EA, the following revisions were made:

- The level of detail regarding Delta II launches from Vandenberg was further reduced because the SLC-2W EA has been completed.

Comments on the MSX DEA were received from the following:

- SDIO/TNS - Major Eric Imker,
- SDIO/GC - Ms. Judith Hightower,
- SDIO/SIS - LtCol Robert Peavey,
- AF/CEVP - Mr. John Babicz,
- AF SSD/DEV - Major Thomas Lillie,
- USASDC/CSSD-EN - Mr. Dennis Gallien,
- JHU/APL - Mr. Max Peterson,
- MIT/LL - Mr. Michael Judd, and
- USU/SDL - Mr. Harry Ames.

Comments were requested, but not received from SDIO/IEA and NASA.

PFEA COMMENTS

An internal review copy of the Preliminary Final MSX EA (with DEA comments incorporated) was submitted to SDIO/TNE, TNS, and GC on 28 October 1991. Copies were sent on 16 January 1991 through HQ USAF/CEVP at The Pentagon to 30 SPW/XPR at Vandenberg AFB and AFSPACECOM/DEPV at Peterson AFB. Comments on the internal review copy PFEA were received from SDIO/GC, LtCol Michael J. Van Zandt, and from HQ USAF/CEVP, David C. Van Gasbeck. The comments included editorial revisions and the following general topic areas:

- Incorporation by reference of the STARS EA and ODES CATEX;
- MSX alternative analysis;
- Safety system review;
- Environmental setting description of Vandenberg AFB;
- Verification of agency consultation process by NASA;
- JHU/APL construction activity to remain in EA;
- Satellite deorbit considerations, and launch frequency; and
- NEPA coverage of contractor-owned, contractor-operated facilities.

The last two sections of the report reflect the responses to SDIO/GC and HQ USAF/CEVP comments.

SDIO/TNS - Major Eric Imker

SDIO/TNS - Major Eric F. Imker
(Comments on 9 August 1991 DEA)

General Comments

1. COMMENT: There may be additional dedicated target missions developed over the next two years. Would these missions need to be included in this EA when they are conceived or can we state our intentions with an open statement in the EA now?

   RESPONSE: If the additional target missions fit within the scope of the MSX EA or other EAs that can be referenced (STARS, EDX, and MMI) then they will not need additional documentation. If the additional targets do not fit within the scope of the MSX or referenceable EAs, then supplemental documentation would have to be prepared.

2. COMMENT: Dames & Moore must be certain that these EAs incorporated by reference--particularly the (as of yet) uncompleted NASA EA for the Delta II launches out of Vandenberg AFB--cover the MSX issues which Dames & Moore has assumed they will cover.

   RESPONSE: The SLC-2W EA was signed 21 January 1992. The final SLC-2W EA was reviewed for consistency with the assumptions used in the MSX EA prior to finalizing the MSX FEA.

3. COMMENT: The STARS program will be delayed and might be canceled. This would require a different booster for the dedicated target missions. We won't knew for several months. If STARS is terminated, all references to STARS in the MSX EA would require rewriting.

   RESPONSE: The MSX EA addresses the MSX dedicated targets (including STARS), as presently configured, as representative of target boosters that can be used. Should the STARS program be terminated, a supplement to the MSX EA can be avoided if a replacement booster has completed environmental documentation.

SDIO/TNS (continued)

Specific Comments

1. COMMENT: page vii: add CQCM, Cryogenic Quartz Crystal Microbalance.

   RESPONSE: Acronym has been deleted and reference in the text was removed. The EA was streamlined to present only infomration with direct linkage to environmental impacts.

2. COMMENT: page viii: Delete this page. It duplicates page vii.

   RESPONSE: Page has been deleted.

3. COMMENT: page ix: Add Ground-Based Interceptor (GBI)

   RESPONSE: Acronym has been added.

4. COMMENT: page xii: Delete the word "and" from the SPIRIT III acronym.

   RESPONSE: Word has been deleted.

5. COMMENT: page xiii: Change UMDF to "UDMH, Unsymmetrical di-methyl hydrazine".

   RESPONSE: Correction has been incorporated.

6. COMMENT: Page 1-2, para 1, sent 1: Change to read, "SDIO is developing a Strategic Defense System (SDS), which will consist of sensors and interceptors used..." Insert this sentence next: "MSX will be a space-based sensor serving as a data gathering experiment for the SDS sensor elements."

   RESPONSE: Section 1.0 has been revised to better describe the program.

SDIO/TNS (continued)

7. COMMENT: Page 1-5, para 2: Delete first sentence. Change: "It will operate ... similar..." to "MSX will operate ... realistic...". Change last sentence to read: "...provide the information on sensor functions necessary...".

RESPONSE: Section 1.0 has been revised to better describe the program.

8. COMMENT: Page 2-1, fourth line: Insert after (BE); "Ground-Based Interceptor (GBI)"; Seventh line. Delete the word "and" from the SPIRIT III acronym.

RESPONSE: Section 2.1 has been revised and this information moved to Section 1.0.

9. COMMENT: Page 2-1, bottom para: Change entire bottom paragraph to read: "The type of sensors being used for MSX are passive optical systems. The MSX sensors will image the incident radiation from targets and backgrounds onto a photosensitive array of detectors. The detectors generate a series of electrical signals that are recorded and later transmitted to ground receiving stations. Scientists will then process the data by computer to characterize the targets and backgrounds. Each type of ... radiate in relatively...". (Deleting the word "the" in the last line.)

RESPONSE: Paragraph has been deleted because it was too detailed and the information contained did not drive impacts.

10. COMMENT: Page 2-4, First line: Change (IR) to (SWIR). Second line: Change first IR to "spectral". Change second IR to "the spectrum".

RESPONSE: Paragraph has been deleted because it was too detailed and the information contained did not drive impacts.

11. COMMENT: Page 2-4, Second paragraph, last line: Change "rocket" to "satellite".

RESPONSE: Paragraph has been deleted because it was too detailed and the information contained did not drive impacts.

SDIO/TNS (continued)

12. COMMENT: Page 2-5, Last paragraph: Change "21 months" to "approximately 21 months". Change "solar cells" to "solar panels".

RESPONSE: Sentence now reads "approximately 2 years". Sentence containing "solar cells" was deleted.

13. COMMENT: Page 2-6, sec 2.1.2.2: Delete the word "and" from the SPIRIT III acronym.

RESPONSE: Word has been deleted.

14. COMMENT: Page 2-6, Last paragraph: Change "Quartz-Crystal Microbalance (QCM)" to "Cryogenic Quartz-Crystal Microbalance (CQCM)"

RESPONSE: Paragraph has been deleted because it was too detailed and the information contained did not drive impacts.

15. COMMENT: Page 2-7, Third line: Change "SPIRIT II" to "SPIRIT III". Sixth line: Change "a longer design life of" to "a design life goal of". End of second paragraph. Add: Hydrogen cold tests are done at Lockheed.

RESPONSE: Paragraph has been deleted; information did not drive impacts.

16. COMMENT: Page 2-10, First paragraph: Delete sentence: "It can also ...

RESPONSE: Paragraph has been deleted because it was not linked to environmental impacts and all pertinent information was moved to other sections.

17. COMMENT:Page 2-15, End of third paragraph: What if commercial services change? Last line: Uncertain what ABRES A-3 refers to.

RESPONSE: Paragraph has been deleted because it was too detailed and the information contained did not drive impacts.

SDIO/TNS (continued)

18. COMMENT: Page 2-16, sect 2.1.4.1: Is this section necessary given that vehicle EA is incorporated by reference?

RESPONSE: Section 2.1.4.1 deleted. Section 2.1.4 has been revised to include only the necessary details from section 2.1.4.1.

19. COMMENT: Page 2-21, Third paragraph: Insert: "Phillips Laboratory" into acronym.

RESPONSE: Change has been incorporated and the text moved to Section 2.1.7.

20. COMMENT: Page 2-22, Section 2.1.7: What happens if the ODES configurations change?

RESPONSE: Changed configurations would be reviewed at that time for consistency with the ODES Record of Environmental Consideration (USASDC, 1990b).

21. COMMENT: Page 2-22, Section 2.1.7.1: There will also be an EIS done! Also, is this section necessary given that it is incorporated by reference?

RESPONSE: Section has been deleted and any pertinent information has been moved to section 2.1.8.

22. COMMENT: Page 2-24, ODES Payload paragraph: Change "conduct MSX experiments" to "conduct MSX target experiments." Change "Experiments are accomplished" to "Experiments are also accomplished."

RESPONSE: Paragraph has been deleted and ODES information is now in Section 2.1.8.

23. COMMENT: Page 2-25: Change "N_2O_4" to read nitrogen tetroxide.

RESPONSE: Nitrogen tetroxide is now spelled out throughout the EA. Discussion of the fuel vent payload that refers to the nitrogen tetroxide is now in section 2.1.8.

SDIO/TNS (continued)

24. COMMENT: Page 2-26: Third paragraph: Change to read "MSX has influence on scheduling and configuration of the first four EDX missions.

RESPONSE: Section has been deleted and EDX information is now in Section 2.1.9.

25. COMMENT: Page 2-27, Section 2.1.9: Change KREM to KREMS. Delete the comma between PL/GD and KC-135.

RESPONSE: Changes have been incorporated.

26. COMMENT: Page 2-28, End of section 2.3.1: Add "See Figure 2-3."

RESPONSE: Figure reference has been added - now Figure 2-5.

27. COMMENT: Page 2-29: What information is TBD, and why? Else recommend deleting this statement.

RESPONSE: Analysis by others, to support section 2.3, had not been received for the DEA. It has since been received and included in the administrative record.

28. COMMENT: Page 3-3, Third line: Insert "and" after flights.

RESPONSE: Word has been inserted.

29. COMMENT: Page 3-4, Last paragraph, third line: Insert after Facilities; "and cleanroom facilities".

RESPONSE: Construction at JHU/APL has been deleted from this Chapter and discussed in chapters 2 and 4.

SDIO/TNS (continued)

30. COMMENT: Page 3-8, First paragraph: Change "pais" to "pairs". Third paragraph: Change "proved" to "provides".

RESPONSE: Spelling has been corrected.

31. COMMENT: Page 4-5, Second line: Subscript the 3 in 03.
Second paragraph: Change "postlaunch" to prelaunch".
Third paragraph: Change "include two the Delta" to "include the Delta".

RESPONSE: Changes have been incorporated, except for the third paragraph that was deleted because it was too detailed and the information contained was not linked to impacts.

32. COMMENT: Pages 4-7 to 4-9: Change UMDH to UDMH in four occurrences in these three pages.

RESPONSE: Spelling has been corrected.

33. COMMENT: Pages 4-5 to 4-7: The discussion of activities at VAFB does not explicitly detail how the NASA (the PPF and PCF) will be used. Some discussion of payload processing is included but without connection to the specific NASA buildings.

RESPONSE: This information was the subject of a supplemental data request and has been included in the FEA in chapters 2 and 4.

34. COMMENT: Page 4-13, Third line from bottom: Change will to would.

RESPONSE: Word has been corrected.

SDIO/GC - Ms. Judith Hightower

SDIO/GC - Judith Hightower
(Comments on 9 August 1991 DEA)

General Comments:

1. COMMENT: In our view the major issues with the EA that will require additional work are the use of the SLC-2W EA and the environmental effects of satellite activities on the U.S. We do not believe that it is advisable to rely on the SLC-2W EA until it is completed. Further, is seems that the issues associated with the satellite activities on the U.S. require a greater level of analysis than is presently contained in the EA. For example, we must consider whether the satellite will interfere with other satellites, whether the satellite may possibly deorbit or whether emanations on board the satellite may cause impacts on the ground in the U.S.

   RESPONSE: The SLC-2W EA FONSI was signed 21 January 1992. Issues associated with satellite activities in the U.S., and the environmental effects of these activities, are addressed in the EA; see response to comment 18 for specific locations in the EA.

Specific Comments:

1. COMMENT: Page 1-1, para 1: The last sentence of this paragraph states that the EA will analyze the "... environmental consequences of technology and sensor system testing activities" of MSX. This statement gives the impression that other aspects of MSX will not be analyzed under the EA. The sentence should be revised to clarify that the EA will analyze all aspects of the MSX program.

   RESPONSE: Sentence has been revised to include that the potential environmental consequences of all aspects of the MSX program will be analyzed.

2a. COMMENT: Page 1-2, para 1: There should be a lead-in to this paragraph which explains what SDI is all about. Following the lead-in the first two sentences in this paragraph should be revised as follows: "The SDS, which MSX will help develop, may consist of sensors and weapons used in concert to identify, engage, track, and destroy attacking missiles, post boost vehicles (PBVs), and warheads or reentry vehicles (RVs). MSX sensors are designed to detect the presence of simulated PBVs, and RVs ..." In the fourth sentence in the same paragraph, the following phrase should be added at the end of the sentence: "...such as the aurora borealis in the northern lights."

SDIO/GC (continued)

RESPONSE: Several lead-in paragraphs have been added to the Concept and Background section that explain basic concepts of the ballistic missile defense system. The sentence that you suggested needed revising has not been retained, although the topics have been covered in new paragraphs in the Concept and Background section.

2b. Is there an alternative to the polar orbit that will allow the MSX satellite to build up a database on sensor backgrounds over most regions of the globe?

RESPONSE: Section 1.0 was rewritten for clarity. Portions of the requested additions were included in Section 2.1.1. There is no practical alternative to a polar orbit for gathering the required data. With a polar orbit, the satellite will circle through all the earth's latitudes, which is needed to develop a phenomenology and surveillance database.

3. COMMENT: Page 1-2, para 2: Why is the information in this paragraph important? This paragraph should answer the question of what the technical issues are to be resolved by the MSX that can not be done some other way?

RESPONSE: Section 1.0 was rewritten to better describe the need for the program.

4. COMMENT: Page 1-5: The statement in the first sentence which states that "MSX will be the first space-based sensor serving as a functional prototype of the SDS midcourse sensor elements" is incorrect. Also the ABM treaty implications of a space-based sensor must be considered.

RESPONSE: The sentence was deleted during revision of Section 1.0. ABM Treaty issues are outside the scope of this document.

5. COMMENT: Page 2-1, sec 2.1.1: If at all possible the section on the concept and background of MSX should be simplified. This opening section seems very technical and is difficult to read. The key is to make the information readable and easily understandable by the ordinary reader. Include only as much as is necessary to give a general description of the MSX program and its history.

RESPONSE: Section has been revised to include a general description of GPALS and a simplified description of MSX and the MSX satellite.

SDIO/GC (continued)

6. COMMENT: Page 2-6, sec 2.1.2.1., para 3: The sentence which states "The fabrication of electronic modules requires a facility which utilizes corrosive chemicals" should be clarified to explain that the existing facilities at JHU/APL are suitable for the use of corrosive chemicals, if this is the case. Also, what types of corrosive chemicals are involved?

   RESPONSE: The referenced discussion was deleted because the electronic modules fabrication area is an existing facility that will not be changed by MSX and no MSX related impacts will result.

7. COMMENT: Page 2-7, sec 2.1.2.2, para 1: Is there anything unusual about the solid hydrogen that will be used to cool the SPIRIT III?

   RESPONSE: No. Cryogenic hydrogen and storage dewars of the type used on SPIRIT III have been used previously on other experiments. Special handling procedures need to be in place to use cryogens.

8. COMMENT: Page 2-7, sec 2.1.2.2, para 3: A description of the system safety program should be included in the EA. At a minimum, its location and availability for review should be noted.

   RESPONSE: Section 2.1.2 discusses the MSX system safety program and JHU/APL's responsibility for the program, its documentation, and availability.

9. COMMENT: Page 2-9, sec 2.1.2.4., para 2. Who will procure the components of the UVISI instrument? Are there any consequences to the people in Buildings 13 and 14 associated with the fabricating activities? The first sentence in this paragraph is confusing and should be rewritten.

   RESPONSE: The material has been rewritten to indicate that JHU/APL will both outsource and internally fabricate UVISI components. There will be no consequences to personnel that are attributable to MSX.

SDIO/GC (continued)

10. COMMENT: Page 2-9, sec 2.1.2.5, para 1. The second sentence in this section is unclear. To whom or what does the word "they" refer? Please clarify.

RESPONSE: *They* refers to the designers of the SPIRIT III experiments. Discussion of the reference objects is now found in section 2.1.3.

11. COMMENT: Page 2-12, sect 2.1.3, para 2. What is the effect of purging the cryogenic fluids used for testing? Where will the fluids be purged?

RESPONSE: After the cryogens have been removed, the spacecraft will be ready for travel. The cryogens will be purged at GSFC.

12. COMMENT: Page 2-15, sec 2.1.4, para 2: MSX is not a proponent for the launch complex. Also, isn't there a Delta document for the launch?

RESPONSE: Section has been rewritten. The title of the SLC-2W EA is misleading; the scope of the EA includes both the modifications of and launches from SLC-2W launch area at Vandenberg AFB.

13. COMMENT: Page 2-16, sec 2.1.4.1, para 2: What are the environmental consequences of using liquid RP-1 (kerosene) and liquid oxygen in the first stage? How much of each substance involved?

RESPONSE: RP-1 (kerosene) and liquid oxygen were discussed in the DEA as background information. This section has been revised and unnecessary detail cut. The SLC-2W assesses the impacts of the launch vehicle.

14. COMMENT: Page 2-16, sec 2.1.4.1, para 4: What are the environmental consequences associated with using nitrogen tetroxide and Aerozene 50 propellants? How much of each substance is involved?

RESPONSE: See response to comment #13.

SDIO/GC (continued)

15. COMMENT: Page 2-18, sec 2.1.4.2, para 1: The Delta II launch azimuth, trajectory and impact area information should be included in the EA before it is finalized. In the second paragraph, the future trajectory needs elements to assess what are typical trajectories.

RESPONSE: The SLC-2W EA assesses the impacts associated with the Delta II launches and is incorporated by reference.

16. COMMENT: Page 2-18, sec 2.1.4.3, para 1. Will the safety plans for the Delta II launch vehicle be included in the EA or made available for inspection at another location? If so, the EA should so specify. Again, the future plans need elements to assess.

RESPONSE: System safety plans are being coordinated through JHU/APL with McDonnell Douglas Space Systems. When documentation is finalized, it will be available at the program office, JHU/APL, and onsite at Vandenberg AFB.

17. COMMENT: Page 2-20, sec 2.1.5, para 3: The environmental consequences of releasing hydrogen into space on a regular basis must be addressed in the EA.

RESPONSE: The request has been addressed in Section 4.3 of the EA.

18. COMMENT: Page 2-21, sec 2.1.5, para 2: The satellite's projected orbit for several hundred years does not negate the requirement to consider the effects of the spacecraft's re-entry to the earth's atmosphere in this document. Some of the space issues related to impacts to the human environment are: 1) Fails to achieve orbit; 2) deorbits into U.S.; 3) Interferes with other satellites; 4) Adds to orbital debris which interferes with other satellites; 5) Emanation on board causes impact on ground in U.S. (laser); 6) Radio frequency block assignment; and 7) Satellite orbit block assignment. Also, the EA must address the issue of who will be responsible for returning the spacecraft to the earth's atmosphere.

SDIO/GC (continued)

RESPONSE:

1) Should the spacecraft fail to achieve orbit, the spacecraft and the upper stage(s) of the Delta II rocket are expected to impact the Broad Ocean Area or in the Antarctica. Launch debris would not impact in the U.S or populated areas of another country.

2) Assuming the spacecraft reaches its planned orbit, it is not expected to deorbit for several hundred years. Program plans for MSX and other U.S. satellites do not include deorbit capability or deorbit plans. Section 4.3.3, Spacecraft Deorbit, has been expanded to more fully analyze impacts upon deorbit.

3, 4, 6, 7) These activities are the responsibility of CSTC (see section 4.3.1, Spacecraft Operation).

5) Radio transmission from the spacecraft will not cause ground impacts, due to broadening and weakening of the beam with distance. No lasers will be used.

Modifications to the EA have been made in sections 2.1.6, 4.3.1, and 4.3.3.

19. COMMENT: Page 2-22, sec 2.1.7: The second sentence in the paragraph should be deleted since it is unnecessary to state that there is no funding available for other target launches. These experiments have been previously assessed and were categorically excluded from further analysis.

RESPONSE: Sentence has been deleted. Analysis of the MSX dedicated targets has been retained in the EA as these are an integral part of the MSX program.

20. COMMENT: Page 2-22, sec 2.1.7.1: This section should be deleted in its entirety.

RESPONSE: The section has been deleted and all appropriate information has been revised and moved to section 2.1.8, Dedicated Targets.

SDIO/GC (continued)

21. COMMENT: Page 2-23, Table 2-2: The information in the Table relating to STARS/ODES, STARS/c.f.e. and STARS/ODES should be deleted.

RESPONSE: The table has been retained as an aid to the reader regarding MSX dedicated targets.

22. COMMENT: Page 25, sec 2.1.7.2: A summary of the issues and mitigations should be included in this section.

RESPONSE: Section 2.1.7.2 has been revised and all appropriate information, including a summary of the issues and mitigations, has been included in section 2.1.8.

23. COMMENT: Page 2-26, sec 2.1.8: The information in this section is not MSX related.

RESPONSE: MSX will interact with other target programs; a shortened version of the discussion has been retained in the EA for completeness (see section 2.1.9).

24. COMMENT: Page 2-26, sec 2.1.8.1: The Exoatmospheric Discrimination Experiment is not driven by MSX. Therefore, this section should be deleted.

RESPONSE: This section has been deleted and the information relating MSX to EDX is in section 2.1.9 as an aid to the reader.

25. COMMENT: Page 2-27, sec 2.1.10, para 2: It is not clear that this paragraph covers the proposed construction of an antenna support structure at JHU/APL. Please clarify. Also, the environmental consequences of the construction should be discussed.

RESPONSE: Paragraph has been rewritten and is now section 2.1.11. Environmental consequences of the antenna construction and operation are discussed in Section 4.1.3.

SDIO/GC (continued)

26. COMMENT: Page 2-28, sec 2.1.10, para 1: The EA should specify whether or not there are environmental consequences associated with the construction required at Vandenberg.

RESPONSE: Construction at Vandenberg AFB for Delta II launches is covered by the SLC-2W EA and is not driven by MSX. Detailed discussion of the construction in the MSX EA has been reduced to brief statements only for background purposes.

27. COMMENT: Page 2-28, sec 2.2: It seems that the discussion concerning the no action alternative could be strengthened by stating the impact that the failure to develop mid-course sensors would have on the SDI mission.

RESPONSE: No action on MSX would not result in failure to develop midcourse sensors. Sensor development would continue, but actual flight test data from MSX would not be available. The effect on the SDI mission can be evaluated by referring to section 1.0; such a reference has been inserted in section 2.2.

28. COMMENT: Page 2-28, section 2.3.1., para 1: This paragraph should include an explanation of why easterly launch azimuths at Cape Canaveral Air Force Station in Florida are not acceptable for launch of the MSX vehicles.

RESPONSE: Explanation has been included in section 2.3.1.

29. COMMENT: Page 2-29, sec 2.3.2: Would the environmental effects of alternative launch vehicles be that much different with the additional supporting information which is yet to be determined?

RESPONSE: Additional discussion regarding the selection of the Delta II vehicle has been added to Section 2.3.2. Differences in environmental effects between alternate launch vehicles are not significant.

SDIO/GC (continued)

30. COMMENT: Page 3-1, sec 3.1: The reason that all environmental media were not applied in all cases to the locations reviewed should be stated in the EA.

RESPONSE: Section has been revised for clarity.

31. COMMENT: Page 3-4, sec 3.1.3, para 3: The specific construction proposed at JHU/APL, including the antenna support structure, should be restated in this paragraph. Also, the sentence which states that "JHU/APL has, or expects to receive, all required permits" should be clarified to state that applications have been filed for required permits. (Assuming that applications have been filed.)

RESPONSE: Paragraph rewritten and construction information was moved to Chapter 2 and assessed in Chapter 4.

32. COMMENT: Page 3-5, section 3.2., para 2: We believe that reliance on the NASA EA for the SLC-2W will be troublesome. Since the NASA EA is not yet finalized, it is risky to depend on the analysis in that document to support the pre-launch and launch activities for MSX. Further, a document which is not final cannot be incorporated into the MSX EA. In any event, only the areas affected by the MSX experiment need to be discussed in the MSX EA.

RESPONSE: The SLC-2W EA was completed and the FONSI signed on 21 January 1992.

33. COMMENT: Page 3-8, sec 3.2, para 2: Is the information in this paragraph based on existing surveys? If so, it should be stated in the EA.

RESPONSE: Information was based on surveys done for the SLC-2W EA. The discussion of Vandenberg AFB is being abbreviated in the FEA to areas affected by the MSX experiment.

SDIO/GC (continued)

34. COMMENT: Page 3-8, sec 3.2, para 3: In the third line of this paragraph, change the word "proved" to "provide."

RESPONSE: Word has been changed.

35. COMMENT: Page 3-10, sec 3.3.1: Delete this section in its entirety.

RESPONSE: Section has been deleted.

36. COMMENT: Page 3-11, sec 3.3.2. This section should be moved back to section 3.2 to be included with the information on Vandenberg.

RESPONSE: Section has been deleted.

37. COMMENT: Page 4-3, sec 4.1.3, para 3. We are not familiar with the "separate (draft) environmental analysis by SDIO" referred to in the first sentence in this paragraph. Is this a reference to NEPA documentation that is being prepared? In any event, draft documentation cannot be relied on in this MSX EA.

RESPONSE: The separate environmental analysis was a draft (now final) CATEX for the antenna construction activities at JHU/APL, and the description from the CATEX has been incorporated into the EA (section 2.1.11, Construction). An analysis of the construction of the antenna support structure, the installation of the antenna, and the operation of the antenna can be found in section 4.1.3.

38. COMMENT: Page 4-4, sec 4.2, para 1: When will the SLC-2W EA be final?

RESPONSE: The SLC-2W FONSI was signed 21 January 1992.

SDIO/GC (continued)

39. COMMENT: Page 4-4, section 4.2, para 3: The EA should address the capacity of the sealed catchment basins compared to the amount of washdown water that can be expected.

RESPONSE: The requested information is assessed in the SLC-2W EA and therefore not incorporated into the MSX EA.

40. COMMENT: Page 4-5, sec 4.2, para 2: The hypergolic fuels and their vapors from the Delta II rocket and vapors from the venting of cryogenic liquids on the MSX which will be released during post launch maintenance are not permitted.

RESPONSE: Hypergolic liquids used on the MSX spacecraft will have minor emissions at Vandenberg AFB; no permits will be exceeded by the MSX spacecraft. Delta II emissions are permitted.

41. COMMENT: Page 4-5, sec 4.2, para 3: The existing air permits referred to in the third sentence are not launch related. They apply to ancillary equipment. Also, is it possible to quantify the amount of HCl that will be emitted?

RESPONSE: The discussion of air permits has been revised.

42. COMMENT: Page 4-6, sec 4.2., para 2: What is the volume of wastes that could be generated in the event of a liquid propellant spill compared to the capacity of the spill containment structure?

RESPONSE: The requested information is not MSX related and has not been incorporated. The SLC-2W EA assesses the impacts of the launch. The MSX EA assesses the impacts that the MSX satellite brings to the launch. No liquid propellant is used on the satellite.

SDIO/GC (continued)

43. COMMENT: Page 4-6, sec 4.2., para 4: What size are the ESQDs that will be established around the storage areas and the launch pad? Also, what size is the Ground Hazard Area established for the launch? This information should be stated in the EA.

RESPONSE: The ESQDs and GHA for the Delta II launch will be unchanged for the MSX spacecraft payload.

44. COMMENT: Page 4-7, sec 4.3: A summary of the impacts and mitigations of the MSX target operations should be in Chapter 2.

RESPONSE: This information has been included in Section 2.1.8 and 2.1.9.

45. COMMENT: Page 4-7, sec 4.3.1: Delete this section in its entirety.

RESPONSE: Section has been deleted.

46. COMMENT: Page 4-8, sec 4.3.2: Delete this section in its entirety.

RESPONSE: Section has been deleted.

47. COMMENT: Page 4-9, sec 4.3.4: Delete this section in its entirety.

RESPONSE: Section has been deleted.

48. COMMENT: Page 4-10, sec 4.4.1, para 1: Delete the word "Control" in the seventh line of this paragraph.

RESPONSE: Paragraph has been revised (see section 4.4 on Cumulative impacts).

49. COMMENT: Page 4-11, sec 4.4.2.1, para 3: Delete this paragraph.

RESPONSE: Paragraph has been deleted.

SDIO/GC (continued)

50. COMMENT: Page 4-12, sec 4.4.2.1: Delete this section in its entirety.

RESPONSE: Section has been deleted.

51. COMMENT: Page 4-12, sect 4.5: The EA should include the environmental impacts of all of the alternatives considered, including the no-action alternative, in accordance with section 1508.9(b) of the CEQ regulations.

RESPONSE: The EA includes the impacts of the proposed action and the no-action alternative. It included a description and rationale for alternatives that were considered but not carried forward; detailed analysis of those alternatives is not required. The environmental consequences section of the no-action alternative has been revised for clarity.

52. COMMENT: The EA should include a list of the agencies and persons consulted in accordance with section 1508.9(b) of, the Council on Environmental Quality (CEQ) regulations.

RESPONSE: The list was not planned to be included in the DEA, and has been included in the FEA.

53. COMMENT: Recommend that a summary section be added to the EA to cover the following areas: 1) Conflicts with Federal, State, local or Indian Tribe land use plans, policies and controls; 2) Energy Requirements; 3) Natural or Depletable Resource Requirements; 4) Adverse Environmental effects that cannot be avoided; 5) Relationship between short-term use of man's environment and the maintenance and enhancement of long term productivity; and 6) irreversible or irretrievable commitment of resources.

RESPONSE: Previous direction from SDIO/TNE and GC has been not to include the requested materials in SDIO EAs.

SDIO/SIS - LtCol Robert Peavey

SDIO/SIS - LtCol Robert Peavey
(Comments on 9 August 1991 DEA)

1. COMMENT: As a reminder, the "For Official Use Only" protective use marking should be removed from the final version of the EA. The final version is for public release and therefore no longer needs protection.

RESPONSE: The FOUO marking will removed from the final version that is approved for public release.

AF/CEVP - Mr. John Babicz

AF/CEVP - John Babicz
(Comments on 9 August 1991 DEA)

1. COMMENT: Page 1-2, para 1, sent 1: What are we talking about, SDS or MSX? Why is MSX needed?

   RESPONSE: Section 1.0 has been rewritten for clarity.

2. COMMENT: Page 1-2, para 1, sent 2: Change "will" to "would" - global implication.

   RESPONSE: Section 1.0 has been rewritten for clarity.

3. COMMENT: Page 1-2, para 1, sentences 5 and 6: Say MSX would fly in a Polar orbit.

   RESPONSE: Section 1.0 has been rewritten for clarity.

4. COMMENT: Page 1-2, para 2: Are there other launches that are to be tracked as part of this program to be assessed - if so, let's introduce--or will that track other launches from other programs.

   RESPONSE: Section 1.0 has been rewritten for clarity.

5. COMMENT: Page 1-4, figure 1-2: Better description needed in Sect 1.0 (targets, backgrounds). MSX Spacecraft--What is this? It was not introduced in the text in Chapter 1.

   RESPONSE: Section 1.0 has been rewritten to better describe the program.

6. COMMENT: Page 1-5, line 2: Can we say test prototype sensors?

   RESPONSE: Sentence has been deleted.

AF/CEVP (continued)

7. COMMENT: Page 2-4, para 1, sent 3: Is this sentence needed? If so, what fuel supply needs would be present to drive environmental concerns?

RESPONSE: The electric motors will be powered by solar energy. Sentence has been deleted for clarity.

8. COMMENT: Page 2-4, para 2: Should be moved to Chapter 1. Are these dedicated launches (sent 1) part of this project? Are they analyzed here?

RESPONSE: Chapter 1 discusses only the purpose and need, therefore, a discussion of targets will not be included. MSX target discussion in the baseline and environmental consequences sections of the EA has been eliminated. The DOPAA has been scaled back to include brief descriptions of the dedicated and nondedicated targets and the environmental documentation that covers those targets.

9. COMMENT: Section 2.1.3 - Where are the alternatives?

RESPONSE: Alternatives are located in Sections 2.2 and 2.3.

10. COMMENT: Section 2.1.4 - How many launches will take place under this action?

RESPONSE: Section has been rewritten. Only one Delta II launch will be required to launch the MSX satellite.

11. COMMENT: Page 2-12, para 3, sent 4: This looks like some action that might have impacts.

RESPONSE: Sentence has been rewritten. Liquid helium is being used for testing activities at JHU/APL and NASA/GSFC; no potential for significant impacts is foreseen.

AF/CEVP (continued)

12. Page 2-12, para 3, sent 5: What is "nutation?" Has the EA been provided to VAFB (Paul Klock) for review and comment?

RESPONSE: The nutation control system is an attitude adjustment system that controls teetering of the satellite. A copy of the PFEA has been sent to Mr. Klock.

13. COMMENT: Page 2-13, para 1, sent 3: Where would the tracking be, over the water or over Lompoc?

RESPONSE: The tracking will occur over water and continue until the flight vehicle is even with the northern Mexico latitudes. Tracking will be over water.

14. COMMENT: Page 2-13, para 3, sent 1: Have the Delta II 7920 configurations been assessed for impacts?

RESPONSE: The Delta II 7920 configuration was assessed in the SLC-2W EA (NASA, 1991). The FONSI for the SLC-2W EA was signed 21 January 1992.

15. COMMENT: Page 2-13, para 3: Should be moved to Chapter 3, history.

RESPONSE: Paragraph has been deleted, information was seen as too detailed.

16. COMMENT: Page 2-13, para 3: State where the rockets are proposed to be launched from. Don't we know how many space booster launches have occurred from VAFB?

RESPONSE: Section has been rewritten for clarity (see section 2.1.5 in the Final EA). Because MSX is assessing payload activities at Vandenberg and is incorporating the SLC-2W EA by reference, the number of booster launches from Vandenberg AFB was not needed for the analysis.

AF/CEVP (continued)

17. COMMENT: Page 2-13, para 4: Are these impacts part of this program? How are the construction requirements being addressed in the ElAP.

RESPONSE: The construction at SLC-2W and the subsequent Delta II launches from SLC-2W were assessed in the SLC-2W EA (NASA, 1991) that is incorporated by reference in the MSX EA.

18. COMMENT: Page 2-14, figure 2-2: Is there any alternate location other than the SLC-2W?

RESPONSE: Refer to section 2.3.1 in the Final EA.

19. COMMENT: Page 2-14, para 1: Cannot tier off of or reference an unfinished document.

RESPONSE: At the time of AF/CEVP's review, the SLC-2W EA was undergoing final review. The SLC-2W FONSI was signed in January 1992.

20. COMMENT: Page 2-15, para 1, sent 1&2: Combine sentences and delete "This EA will" and replace with "To"; delete "start of schedule."

RESPONSE: Paragraph has been rewritten for clarity.

21. COMMENT: Page 2-15, para 2: Move to Chapter 4. Only talk about program action and alternatives here in Chapter 2.

RESPONSE: Paragraph has been deleted.

22. COMMENT: Page 2-15, para 3, sent 3: Is the refurbishment of the ABRES A-3 launch pad part of this proposed action?

RESPONSE: No. Sentence has been deleted.

AF/CEVP (continued)

23. COMMENT: Page 2-16, para 5, sent 3: Does the payload fairing drive impacts?

RESPONSE: Section 2.1.4.1 has been revised to exclude technical details that do not drive impacts.

24. COMMENT: Page 2-18, para 1: Can we specify in some kind of terms? Overland? Using routes over water, used and assessed in other studies?

RESPONSE: Figure 2-5 gives the range of launch azimuths for the launch from Vandenberg AFB.

25. COMMENT: Page 2-20, para 2: Move to Chapter 1. Does the spacecraft re-enter atmosphere and affect the environment at the end of the lifecycle?

RESPONSE: See section 4.3.3, Spacecraft Deorbit.

26. COMMENT: Page 2-20, para 3: Delete.

RESPONSE: This information has been expanded and rewritten for clarity.

27. COMMENT: Page 2-21, para 2: Need to address this section better.

RESPONSE: This information has been expanded and rewritten for clarity.

28. COMMENT: Page 2-22, para 1: How are these activities assessed in the USASDC 1990a reference?

RESPONSE: Refer to the STARS EA for complete details of how these activities were addressed.

AF/CEVP (continued)

29. COMMENT: Page 2-25, para 2, sent 3: Delete "C-141 aircraft will transport the MMI missile from Hill AFB" if it is already included in reference document.

RESPONSE: Sentence has been deleted.

30. COMMENT: Page 2-28, para 3: Develop why polar orbit is so important.

RESPONSE: Refer to revised Section 2.3.1.

31. COMMENT: Section 3.1, pages 3-1 to 3-4: This section talks about contractor-owned, contractor-operated facilities. Delete these sections.

RESPONSE: Sections have not been deleted. SDIO includes an explanation and analysis of activities at contractor-operated facilities in all environmental documents.

32. COMMENT: Section 3.2, para 1, sent 4: Are impacts to overflight of these platforms addressed in the document that can be referenced in Chapter 4?

RESPONSE: This information is relevant to a baseline description of Vandenberg AFB and surrounding areas. Safety issues related to overflight of the oil platforms are related to Delta II, not MSX.

33. COMMENT: Section 3.2, para 1, last sent., delete: How would we affect these portions of the land?

RESPONSE: Sentence has not been deleted. This information is relevant to a baseline description of VAFB and surrounding areas.

34. COMMENT: Section 3.2, para 2, sent 3: Only reference complete documents.

RESPONSE: The SLC-2W EA is now complete.

AF/CEVP (continued)

35. COMMENT: Page 3-6, para 1: Provide this information only as it relates to the affected environment.

RESPONSE: Paragraph has been revised to delete unnecessary information.

36. COMMENT: Page 3-6, para 1, last sent: If these activities can be allowed to continue or won't be in safety or accident zones, delete it.

RESPONSE: Sentence has been deleted.

37. COMMENT: Page 3-6, para 4: What are the levels of the air pollutants described here?

RESPONSE: The specific levels of air pollutants are not given. The SLAMS air monitoring station collects data on an hourly basis, publishes the information quarterly and summarizes it annually. For more detailed information, refer to the SLC-2W EA.

38. COMMENT: Page 3-7, para 4: Are there federally listed endangered or threatened wildlife species in the area and can they be affected by the proposed action?

RESPONSE: Paragraph has been rewritten to include species (see section 3.2).

39. COMMENT: Page 3-8, para 2, first sent: Awkward sentence - state what has been found, by whom, and the likelihood of finding others.

RESPONSE: Paragraph has been rewritten for clarity (see section 3.2).

40. COMMENT: Page 3-8, para 3: Delete unless the program will dramatically increase the population, which will drive indirect impacts off base--if it does, then assess.

RESPONSE: This information is relevant to a baseline description of the SLC -2W launch pad. Paragraph has been revised for clarity.

AF/CEVP (continued)

41. COMMENT: Page 3-11, Sect 3.3.2: What is the affected environment here? Can we reference an existing document?

RESPONSE: Section has been deleted and the existing document Environmental Assessment for Minuteman and Thor Missile Launches at Vandenberg AFB is referenced in chapter 2.

42. COMMENT: Page 4-1, para 3, first sent: delete.

RESPONSE: Sentence has not been deleted. SDIO includes an explanation and analysis of activities at contractor-operated facilities in all environmental documents.

43. COMMENT: Sections, 4.1, 4.1.1, 4.1.2, 4.1.3: delete.

RESPONSE: Sections have not been deleted. SDIO includes an explanation and analysis of activities at contractor-operated facilities in all environmental documents.

44. COMMENT: Page 4-4, para 1, sent 2: Need to determine and assess for assurance.

RESPONSE: The SLC-2W EA resulted in a Finding of No Significant Impact. The analysis contained in that document is incorporated by reference into the MSX EA.

45. COMMENT: Page 4-4, para 3: What effect would this have on aquatic life, or where would an accident happen? Need more background on what contaminants are produced; in what quantities they are produced; when released, where do they go, and how are they collected? How much HCl is deposited in surrounding surface waters? Why are we concerned about collecting? What environmental impacts could these products have? More detail is needed on quantities, paths, and processes of toxins (Al_2O_3). How much propellant will fall into the ocean?

RESPONSE: Refer to the SLC-2W EA for more detailed information. This section has been edited to provide only necessary details for the impact analysis of MSX payload activities.

AF/CEVP (continued)

46. COMMENT: Page 4-5, Para 1: Name the chemical releases. What is the quantity of launch exhausts? How will the fuels during launch & prelaunch activities be controlled, especially by the recovery system? What about volatile releases? How much cryogenic liquid will be used? What are the permit requirements and what will be the environmental consequences?

RESPONSE: The impacts from the launch of a Delta II vehicle were assessed in the SLC-2W EA. The impacts from the MSX payload cryogens have been included in sections 4.2 and 4.3.1.

47. COMMENT: Page 4-5, para 2, sentence 2: How small is the area that the emissions will be limited to?

RESPONSE: Refer to the SLC-2W EA for more detailed information.

48. COMMENT: Page 4-5, para 3, sent 5: Skeptical about conclusion that there will be no effects on the Least Tern attributed to launches.

RESPONSE: This paragraph has been revised to reflect the mitigation that Delta II launches will not occur during the nesting season of the California Least Tern.

49. COMMENT: Page 4-6, line 2: Provide reference that stated "During the 29 years ... has been no known adverse impact on threatened and endangered species."

RESPONSE: Section has been revised to reflect the Final SLC-2W EA.

50. COMMENT: Page 4-6, line 3: This sentence should be in Chapter 1.

RESPONSE: This sentence has been deleted from the paragraph.

AF/CEVP (continued)

51. Page 4-6, para 1, sent 3: Is not a firm statement. Find out what would happen if a spill occurred.

RESPONSE: Refer to the SLC-2W EA for more detailed information.

52. COMMENT: Page 4-5, Para 1, sent 4: How much solvents, adhesives, alcohol, lubricant, oil, grease, and fuel will be generated, and what is the probability of that accumulation?

RESPONSE: Refer to the SLC-2W EA for more detailed information.

53. COMMENT: Page 4-6, Para 3, sent 2: What is the ESQD that will be established?

RESPONSE: The ESQD for the Delta II launch will not be changed because of the MSX Spacecraft payload; thus, it is not included in the MSX EA analysis.

54. COMMENT: Page 4-6, Para 3, sent 4: What is the GHA and how far is it?

RESPONSE: The GHA for the Delta II launch will not be changed because of the MSX spacecraft payload; thus, it is not included in the MSX EA analysis.

55. COMMENT: Page 4-7, line 3: What does this term, "uncontrolled area" mean?

RESPONSE: Uncontrolled refers to a public area. The sentence has been revised to reflect this (see section 4.2).

56. COMMENT: Page 4-7, last sentence: Where is the flight route? What about explosions/catastrophic failure?

RESPONSE: MSX will fly over water until it reaches orbit (see section 4.2).

AF/CEVP (continued)

57. COMMENT: Page 4-8, sect 4.3.2: Is this 1976 EA still valid in reference to air quality standards, cumulative impacts.

RESPONSE: Discussion moved to section 2.1.8. The referenced EA is the environmental document for MMI launches at Vandenberg AFB.

58. COMMENT: Page 4-8, para 3, sent 5: Why was it concluded that there would be no impacts to hazardous waste or water quality for MMI launches, when such impacts were identified for Delta II launches?

RESPONSE: Impacts to hazardous waste and water quality from Delta II launches were identified as potential impacts, which were found to be not significant.

59. COMMENT: Page 4-8, para 3, sent 6: Please convince me that no cumulative impacts were found.

RESPONSE: The conclusions regarding cumulative impacts are from the referenced EA for MMI launches and need not be reexamined for MSX.

60. COMMENT: Page 4-9, first sentence: Because the launches are routine, does not mean that impacts would not be significant.

RESPONSE: See response to Comment 59.

61. COMMENT: Page 4-9, para 1, sent 3: "... or an impact with the ocean ..." How can you say this? What is the probability of hitting a populated area?

RESPONSE: As originally written, paragraph 1 intermixed spacecraft releases while on orbit and target releases in suborbital trajectories; it has been rewritten to separate spacecraft and target releases. Targets releases from suborbital trajectories will land in the Broad Ocean Area between KTF and USAKA (STARS/ODES) and VAFB and USAKA (MMI). Prevailing opinion is that objects returning from space/subspace burn up on reentry or breakup on impact with the ocean. There will be no overflight of land for target flights and minimal probability of hitting a populated area.

AF/CEVP (continued)

62. COMMENT: Page 4-9, para 1, sent 5: How much is this contribution to space debris?

RESPONSE: Actual releases of hard objects in space from the MSX spacecraft will consist of four reference objects, each one being 2 centimeters in diameter; used for SPIRIT III calibration. Impacts from these spheres will be negligible, and discussion of them in Section 4.0 has been deleted.

63. COMMENT: Page 4-9, para 1, sent 6: Why will the impact from releases of these materials be not significant?

RESPONSE: Impacts will be not significant because of their small quantities and wide dispersion areas.

64. COMMENT: Page 4-9, para 2, sent 2: 300 km - Is this the condition that MSX will use?

RESPONSE: Yes. This Chemical Release EA discusses release of chemicals at 300 km. The MSX target will be released at 300 km and 1,000 km. Since there is no impact at 300 km there is expected to be no impact at 1,000 km.

65. COMMENT: Page 4-9, sect 4.3.3, para 2: What happens to the fuel?

RESPONSE: The released fuel will be dispersed and thus diluted uniformly over the vehicle's flight path.

66. COMMENT: Page 4-9, sect 4.3.4, sent 1: Restate - MSX will monitor nondedicated targets.

RESPONSE: Discussion has been revised and is now located in section 2.1.9.

67. COMMENT: Page 4-9, sent 2: Why are there no significant impacts from the response of nondedicated targets?

RESPONSE: See response to comment 66.

AF/CEVP (continued)

68. COMMENT: Page 4-10, sect 4.4: Tell me why no cumulative impacts were identified and what was looked at? Air quality? This is a condensed statement.

RESPONSE: Section has been revised and enlarged for clarity.

69. COMMENT: Page 4-10, sect 4.4.1, sent 2: How many additional employees will be hired?

RESPONSE: There will be less than 10 employees hired at USU/SDL and none hired at the other contractor/government facilities. Sentence has been revised for clarity.

70. COMMENT: Page 4-11, para 1, sent 2: Refer to Chapter 3 - Is this when MSX is planned?

RESPONSE: Sentence has been revised for clarity.

71. COMMENT: Page 4-11, para 1, sent 3: What does this sentence mean?

RESPONSE: Sentence has been deleted for clarity.

72. COMMENT: Page 4-11, para 2: Does not seem consistent with previous survey saying no impacts.

RESPONSE: Paragraph has been revised for clarity.

73. COMMENT: Section 6.0, reference list: Why are personal communications referenced?

RESPONSE: Section 6.0 revised for clarity. Documentation of the communications provides key information for the EA and becomes part of the administrative record for MSX.

AF SSD/DEV - Major Thomas Lillie

AF SSD/DEV - Maj Thomas Lillie
(Comments on 9 August 1991 DEA)

General Comments

1. COMMENT: This EA seems to spend a large amount of space on the effects of the Delta II booster, especially in Section 4.2, which is beyond the scope of the document. By so doing, they stand to conflict with the Delta II EA which they incorporate by reference. It would be better to simply reference the final Delta II EA and add some summary statements from it for the sake of completeness.

   RESPONSE: Detail on the Delta II booster has been cut back throughout the document. The information in section 3.0, the affected environment, and section 4.0, environmental consequences, have been checked against the SLC-2W EA to ensure consistency.

2. COMMENT: The ozone depletion of the MSX Mission, which includes the suborbital launches, should be addressed.

   RESPONSE: Possible ozone depletion is discussed in Section 4.3.1.

Specific Comments

1. COMMENT: Page 2-15, para 2.1.4: Reference is made in the second subparagraph to the SLC-2W Modification EA. This EA currently prohibits launches during the Least Tern nesting season, and this should be cited. (See comment re: page 4-5, para 4.2 below.)

   RESPONSE: Information has been added to section 2.1.4 and section 4.2.

2. COMMENT: Page 3-8, para 3.2: The second subparagraph on the page states that "Cultural artifacts that may exist below the surface of the SLC-2W site are protected from disturbance by the facilities and roads now present." We understand that the construction planned to accommodate Delta II includes installing guying piers which will penetrate many feet deep, thereby potentially disturbing underground archaeological or paleontological sites. Hence the statement made is not true.

   RESPONSE: Above mentioned sentence has been deleted and paragraph revised.

AF SSD/DEV (continued)

3. COMMENT: Page 4-5, para 4.2: The last subparagraph on this page refers to a sonic boom near the nesting site which is not expected. The expected noise level of 129 dBA in the Least Tern nesting area agrees closely with data we have obtained on the Delta 7925 booster. However, it states that surveys on the effects on the Least Tern concluded that "there have been no effects on the Least Tern which can be attributed to launches.." It does not mention that the sound levels studied which did not disturb the birds are only up to about 109 dB (according to ET). As a result, the Delta II program currently cannot launch during the 4 1/2 month nesting period. This should be reflected herein.

RESPONSE: The paragraph has been rewritten to reflect the analysis and mitigations contained in the final SLC-2W EA.

USASDC/CSSD-EN - Mr. Dennis Gallien

USASDC/CSSD-EN - Dennis Gallien
(Comments on 9 August 1991 DEA)

1. COMMENT: Page 2-15, para 2, line 1: There is confusion generated here and elsewhere in the document (pp 305, 4-4, 4-11) as to whether or not the environmental assessment for SLC-2W is complete and resulted in a finding of no significant impact. If the document is finished, state so and incorporate by reference. If it is still a draft document, the MSX EA must show the analysis. REASON: Any reference must be available to the public for review.

   RESPONSE: The SLC-2W FONSI was signed on 21 January 1992 and the SLC-2W EA and FONSI incorporated by reference into the MSX EA. Detailed analysis from the SLC-2W EA has been deleted from the MSX document.

2. COMMENT: Page 2-22, para 3, line 2: The Supplement to the STARS EA should also be included as a reference. REASON: Completeness.

   RESPONSE: Reference has been added in Section 2.1.8.

3. COMMENT: Page 2-26, para 3, lines 1 & 2: MSX is never discussed in the EDX EA. Remove this sentence. REASON: Correct statement.

   RESPONSE: Sentence has been removed.

4. COMMENT: Page 2-27, para 4, lines 7 & 8: Is the building addition being done for MSX? If so, must analyze the effects of its construction. REASON: Completeness of analysis.

   RESPONSE: The building addition is being done for JHU/APL. It is being used initially, however, by MSX. The proposed construction of an antenna support structure and the installation of a 10 meter parabolic dish have been added to Section 2.1.11, Construction. The potential impacts of the construction of the support structure and the operation of the antenna are discussed in Section 4.1.3, Johns Hopkins University/Applied Physics Laboratory, Laurel, Maryland.

USASDC/CSSD-EN (continued)

5. COMMENT: Page 3-6, para 2, line 2: Change "form" to "from."

RESPONSE: Spelling has been corrected.

6. COMMENT: Page 3-7, para 3, line 5: Change "vary" to "very."

RESPONSE: Word has been corrected.

7. COMMENT: Page 3-8, para 3, line 3: Change "proved" to "provide."

RESPONSE: Word has been corrected.

8. COMMENT: Page 3-9, para 2, line 4: Is the DOE EA for KTF completed with a finding of no significant impact? If not, the STARS EA would be a better reference throughout the document. REASON: Any reference must be available to the public for review.

RESPONSE: Section has been deleted and references to the KTF EA have been removed throughout the document.

9. COMMENT: Page 4-6, para 4, line 4: Change "with in" to "within."

RESPONSE: Spelling has been corrected.

10. COMMENT: Page 4-10, para 2, line 4: Remove reference to EDX EA. REASON: The EDX EA does not address MSX, therefore, does not address potential impacts of any MSX activity.

RESPONSE: Paragraph has been revised and reference to the EDX EA was removed.

USASDC/CSSD-EN (continued)

11. COMMENT: Page 4-11, para 3, line 2: This sentence is confusing. Clarify how 1,200 missiles account for 675 launches.

RESPONSE: The entire section has been revised. Out of 1,200 launches at Vandenberg AFB, 657 launches have been Minuteman I missiles.

JHU/APL - Mr. Max Peterson

JHU/APL - Max Peterson
(Comments on 9 August 1991 DEA)

1. COMMENT: Page 2-12: Consider adding to the paragraph at the top of the page: "It should be noted that only liquid Helium will be used to cool the SPIRIT III instrument during processing at JHU/APL and NASA/GSFC."

   RESPONSE: Sentence has been added (see section 2.1.3).

2. COMMENT: Page 2-12, 2-13: Check the accuracy of the last two sentences in the paragraph which begins at the bottom of page 2-12 and continues on page 2-13, with respect to MSX. JHU/APL does not plan any operations in Building 1605 and plans to have our Ground Support System (GSS) in Building 836. Maybe these statements were with regard to launch vehicle operations or a previous program.

   RESPONSE: Paragraph has been revised (see section 2.1.5).

3. COMMENT: Page 2-27: The last sentence would be more correct if it stated, "JHU/APL has provided a building addition to house the SCF."

   RESPONSE: Section 2.1.11, Construction, has been revised to only include the construction of the antenna support structure and the installation of the antenna.

4. COMMENT: Page 3-4: In the last paragraph, it would be more correct if the comment "(no additional permits will be necessary)" were removed since we cannot apply for the permit until the design of the antenna pedestal (now in progress) has been completed.

   RESPONSE: Paragraph has been revised (see section 4.1.3).

5. COMMENT: Page 4-3: In the last paragraph, it would be more correct if "...and the antenna was found to not exceed allowable electromagnetic radiation levels..." were replace with "...and appropriate controls and procedures are being established to assure that electromagnetic radiation will be maintained within allowable limits..."

   RESPONSE: The discussion of the electromagnetic radiation hazards has been revised to include the specific controls and procedures that will be established to maintain the radiation within allowable limits.

MIT/LL - Mr. Michael Judd

MIT/LL - Michael Judd
(Comments on 9 August 1991 DEA)

1. COMMENT: Section 2.1.2.5, Reference Objects: Change "2.5 cm diameter" to "2 cm diameter"; change "10 meters per second" to "13 meters per second"; change "Building I" to "Building D".

   RESPONSE: Changes have been made.

USU/SDL - Mr. Harry Aimes

Utah State University/Space Dynamics Laboratory - Harry Aimes
(Comments on 9 August 1991 DEA)

1. COMMENT: I have completed review of the USU/SDL elements of the plan, particularly those regarding the SPIRIT III Sensor. There are no errors in the plan relative to our areas of responsibility.

   RESPONSE: No response necessary.

SDIO/GC - LtCol Michael Van Zandt

SDIO/GC - Lt Col Michael Van Zandt
(Comments on 28 October 1991 internal review copy PFEA)

General Comments

1. COMMENT: We have reviewed the subject EA and find it still has deficiencies which require correction before it can be published. Specifically, the document incorporates by reference the SLC-2W Delta II EA which has not been finalized.

   RESPONSE: SLC-2W EA was finalized at Vandenberg AFB on 21 January 1992.

2. COMMENT: Also, the document incorporates the STARS EA which is currently being reaccomplished as an EIS. MSX related activities on Kauai are being analyzed in the STARS EIS. Although the original FONSI for STARS was upheld in court, there is legal risk in using the STARS FONSI while it is being reanalyzed in the EIS. For example, additional information may require identification of additional impacts or development of new mitigations which were not in the original EA. At any rate, the use of the STARS EA by MSX creates the perception that SDIO is circumventing the direction of the Congress in the FY92 DOD Appropriations Act. We could include the analysis of ODES and its attendant liquid fuels in the MSX EA or we could wait until the STARS EIS is finished. A third alternative is to state that MSX could use another target set called ODES, subject to a final decision on the STARS EIS.

   RESPONSE: Per discussions in an 8 January 1992 meeting between SDIO/TNE, GC, and DMSS, the third alternative has been pursued. The MSX EA will reference the analysis in the STARS EA and ODES CATEX, as appropriate.

3. COMMENT: On the issue of alternatives, the document attempts to use the favorable contract terms received for the Delta II and the fact that one contractor did not propose a launch vehicle to establish the set of reasonable alternatives. These are not defensible criteria. First, does it make a difference environmentally which one of these boosters we use? Second, if so, is there some mission criteria which requires the use of the Delta, such as its availability to meet the schedule? Third, why don't we consider the Shuttle?

   RESPONSE: Section 2.3 and other discussions of alternatives have been revised to incorporate supplemental material received from the MSX program office and direction received at the 8 January 1992 meeting.

SDIO/GC - LtCol Van Zandt (Continued)

Specific Comments:

1. COMMENT: P. F-2, para 3, last sentence: This alternative analysis needs work since the criteria stated is not defensible.

   RESPONSE: See response to General Comment 3.

2. COMMENT: P. E-2, para 3, line 2: Need reason to reject no action.

   RESPONSE: Language added, "it would make the actual flight test data anticipated to result from the experiments unavailable for the continued development of space and ground based sensors. The mission requirements for midcourse sensors development would not be met."

3. COMMENT: P. 1-2, para 1, line 4: Delete reference to SDS and substitute GPALS. The description of SDI and GPALS is very weak.

   RESPONSE: GPALS substituted. The purpose and need section has been strengthened with the addition of an SDI and GPALS description.

4. COMMENT: P. 2-1, Sect 2.1.1: The discussion here misperceives the concept of layered defense, which is not tie to the phases of a ballistic missile flight but rather to the concept of leakage. If we are going to introduce this idea (and we should) then we need to elaborate on how a multi-tiered defense works against a threat.

   RESPONSE: Additional description has been added in Concept and Background section 2.1.1.

5. COMMENT: Table 2-1: Delete the references to Polaris A3. Also what is ABRES?

   RESPONSE: Polaris A3 has been deleted. ABRES stands for Advanced Ballistic Reentry System. It was used in conjunction with an A3 launch site on Vandenberg AFB. The acronym has been deleted.

SDIO/GC - LtCol Van Zandt (Continued)

6. COMMENT: P. 2-7, para 1, line 7: Change handling to use and possession.

RESPONSE: The word "handling" was replaced by the suggested "use and possession".

7. COMMENT: P. 2-7, para 2, line 3: Define dewar.

RESPONSE: Brief definition has been added.

8. COMMENT: P. 2-7, para 3: What power level laser is this? What controls are on the spacecraft for safety? Also, how do we get atmospheric oxygen in space?

RESPONSE: Laser power level information has been added in section 2. Controls for spacecraft safety are discussed in section 4.3.1. Text has been added to clarify the sources of mirror lens contamination.

9. COMMENT: P. 2-8, para 1: What are the test objects made of and will they contribute to the space debris problem? Will they burn up on reentry?

RESPONSE: There are two varieties of reference objects, reflective and emissive. Both types are 2 cm in diameter and are made of aluminum. The emissive test objects are finished with an anodized coating process that roughens the surface and makes it nonreflective. The reflective test object is a hollow aluminum ball with a layer of nickel and then a layer of gold.

The four reference spheres will not survive upon reentry to the atmosphere.

10. COMMENT: P. 2-9, para 2, line 4. Is this specific to the MSX Delta launches as well?

RESPONSE: Rephrasing to include the MSX has been added to end of the fourth sentence.

11. COMMENT: P. 2-12, para 4, line 2. Add "mated" after "will be."

RESPONSE: Addition has been made.

SDIO/GC - LtCol Van Zandt (Continued)

12. COMMENT: P. 2-13, para 3 and 4. The range safety documents which will be prepared create a problem for the environmental analysis. How can we assess the adequacy of plans which have not been prepared? We must know the elements of these plans, at least, in order to determine if there is a risk to human health and/or safety.

RESPONSE: The MSX EA incorporates by reference the SLC-2W EA that covers the modification and operation of the SLC-2W for Delta launches. MSX EA is assessing the payload hazards that the MSX will bring to the Vandenberg AFB launch and range facilities. The loading and venting of the hydrogen in the cryostat is the only special hazard of concern for the MSX satellite. Standard safety operating procedures will be developed.

13. COMMENT: P. 2-16, para 1, line 6. We said back on p. 2-7 that a laser would be used for the mirror cleaning. We cannot make these broad statements. Should say "No laser communication devices will be used."

RESPONSE: Addition made.

14. COMMENT: P. 2-19, para 1. When we incorporate by reference, we need to summarize the issues raised in the document which are relevant to the MSX activities and incorporate the mitigations into the program. We should have this discussion once and not constantly repeat the incorporation throughout the document. We never do summarize what the Delta II issues are or the mitigations.

RESPONSE: Incorporation by reference has been made where appropriate in section 2, and not repeated in subsequent sections. Delta II issues and mitigations are summarized in sections 2.1.4 and 4.2.

15. COMMENT: P. 2-24, para 1, line 13. Can Vandenberg launch on a northerly launch azimuth? We don't show it on the figure and isn't there a problem with populated areas?

RESPONSE: Northerly launches have been deleted from the figure and the title was changed to be specific to orbital launches.

SDIO/GC - LtCol Van Zandt (Continued)

16. COMMENT: P. 2-24, para 2. The alternatives discussion leaves much in question. Are there mission parameters which would drive us to the Delta II, such as availability within the timeframe needed, existence of a launch complex without having to build another one. Remember we do not have to analyze alternatives which will cause more environmental harm.

RESPONSE: See response to General Comment 3.

17. COMMENT: P. 2-25. Why is there no discussion of system safety review for the MSX spacecraft?

RESPONSE: See section 2.1.2, Component Assembly and Testing of the MSX Spacecraft Experiments, for discussion of system safety review.

18. COMMENT: P. 3-1, para 2. The lack of site visits by the contractor undermines the credibility of the document. We must have a validation step by a government person in order to prevent impeachment of the process. The first lesson for the witness in environmental litigation is "GO TO THE SITE."

RESPONSE: Contractor site visits to the JHU/APL facilities have been inserted in the text.

19. COMMENT: P. 3-2, section 3.1. The description of the contractors' facilities should follow a standard pattern. Remember in an EA we are providing sufficient information to demonstrate no additional study is required. Since we are not responsible for environmental compliance at the contractor site, our obligation extends to determining whether existing conditions at the site would cause a significant impact or if the proposed action would exacerbate an existing condition. We need to consider the following:

a. Whether the site has the necessary environmental permits;
b. Whether the site has compliance problems with EPA or the state regulators;
c. Whether the site must add additional personnel;
d. Whether the site must build a new facility for our project;
e. Whether the site must use a regulated material which is toxic or hazardous in connection with our activity?

SDIO/GC - LtCol Van Zandt (Continued)

f. Whether the site will conduct activities entirely within existing facilities;
g. Whether the site is on the NPL;
h. Whether the site will generate excess amounts of hazardous waste from our activity;
i. Whether the site will emanate pollutants from our activity which require a permit, such as air, water, or waste;
j. Whether there is an existing condition at the site which our activity will contribute to which may cause a significant impact, such as nonattainment for air quality, exceedance of wastewater treatment capacity, etc.

At the minimum, for MSX we need to state the activities take place within existing facilities, do not add personnel and the site is in compliance with environmental requirements and has the necessary permits for MSX activities.

RESPONSE: Text describing activities at the contractors' facilities has been rephrased to include the points made in the above paragraph. The environmental background contact sheet that was used to gain information on MSX contractor facilities is included in Appendix A of the EA.

20. COMMENT: P. 3-3 through 3-8. Can we limit the environmental setting discussion to those facts relevant to the preparation of the MSX spacecraft, assuming the SLC-2W EA is finished?

RESPONSE: The text has been edited to limit the discussion of Delta II, as requested.

21. COMMENT: P. 3-6, para 4. I count five endangered or threatened species.

RESPONSE: The text has been revised to list the four endangered or threatened species and one Federal Category 1 species on Vandenberg AFB.

22. COMMENT: What is the status of Section 7, ESA consultation for the listed species? Do we need to do a separate consultation?

RESPONSE: All necessary consultation was conducted by NASA for the SLC-2W EA. MSX does not involve changes or other new information that would require a separate consultation.

SDIO/GC - LtCol Van Zandt (Continued)

23. COMMENT: P. 4.2, section 4.1. See 19 above for the parameters on contractors sites.

RESPONSE: See Response 19.

24. COMMENT: P. 4-4. A figure showing the location of the antenna and other inhabited structures would be nice.

RESPONSE: Reference to the JHU/APL Site Map, Figure 2-6, was added in section 4.1.3.

25. COMMENT: P. 4-4, section 4.2. Why all the discussion on Delta II when we are proposing the MSX.

RESPONSE: The text has been edited to limit the discussion of Delta II, as requested.

26. COMMENT: P. 4-12, para 1. The statement that we do not plan for deorbiting is perplexing. Since the only time we can affect the potential consequences from deorbiting is when we are building the spacecraft, it is absurd to say we will wait several hundred years to answer the question.

RESPONSE: The discussion of deorbiting has been revised to incorporate supplemental material received from the MSX program office and direction received at the 8 January 1992 meeting (see section 2.1.6).

AF/CEVP - Mr. David Van Gasbeck

AF/CEVP - David Van Gasbeck
(Comments on 28 October 1991 internal review copy PFEA)

1. COMMENT: Thank you for the opportunity to comment on the MSX EA. The Air Force has completed a review of the preliminary final of the Midcourse Space Experiment (MSX) Environmental Assessment and the following are our agency's consolidated comments. Our most serious concern relates to the confusing relationship of this proposed action to actions analyzed in separate documents (see 1.a.). We also do not believe that it is possible to reach a FONSI which is based on analysis from an incomplete environmental impact statement (EIS) for the Strategic Target Systems (STARS) program (see 1.b.).

   RESPONSE: See responses to a. and b., below.

a. COMMENT: General. The relationship of the MSX program is confusing as related to other actions. For example, if the STARS program is to provide a dedicated target for MSX, how is it permissible to analyze it in a separate document? Unless STARS has an independent utility, it is improper to analyze it separately. The Council on Environmental Quality's (CEQ) regulation, speaking in the context of an Environmental Impact Statement, states that "proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement." (See 40 CFR para 1502.4(a)) If there is an independent utility for these "dedicated" targets, it should be so stated. Assuming it is proper to analyze these two proposals separately, the MSX document must include enough information to allow the consideration of cumulative impacts from the two proposals.

   RESPONSE: Description of the relationship of the MSX program to other actions has been revised for clarity (see sections 2.1.4 and 2.1.8, and Table 2-1). The proposed action, the MSX program, includes other actions (e.g., Delta II booster, STARS booster, ODES payload buss, Minuteman I booster) that have independent utility and separate environmental documentation. Utilization of these activities by MSX is within the scope assessed in the respective environmental documentation. Therefore, while the actions will be MSX-dedicated, there will be no cumulative impacts associated with these activities that are attributable to MSX.

AF/CEVP (Continued)

b. COMMENT: General. Reference to the STARS EA and analysis is confusing. It is noted that USASDC has initiated an EIS for the STARS program because of strong public interest. Any information incorporated by reference should be based on final documents. Additionally, the STARS EIS may identify significant impacts. Therefore, the MSX proposal may not be eligible for a Finding of No Significant Impact (FONSI).

RESPONSE: The discussion of dedicated targets in the MSX EA has been revised to state that target payloads will be launched on dedicated boosters such as the STARS and MMI, and that only boosters with completed environmental documentation will be used. Finalization of the STARS EIS is not required for a FONSI to be reached on MSX.

c. COMMENT: State how the proposed action would compare to the actions assessed in the SLC-2W EA. Identify the exceptional actions that would create additional or cumulative impacts. State whether the MSX will cause the two launches per year limit as discussed in the SLC-2W EA to be exceeded. Also, this EA should specify if the MSX will be a single launch. If more than two launches per year from SLC-2W are planned as part of the MSX program, detailed analyses for the program will need to be reaccomplished.

RESPONSE: Additional language was added to section 2.1.4 to identify the actions covered in the SLC-2W EA and the MSX EA. The Delta II booster utilized for MSX will have impacts identical to those examined in the SLC-2W EA. Only one Delta II launch from SLC-2W is needed for MSX. Also, the phrase "including MSX" was added to clarify that the single Delta II launch of the MSX spacecraft is included in the two per year launch frequency assessed in the SLC-2W EA. While the SLC-2W EA assessed anticipated payload impacts, aspects of the MSX payload were not explicitly covered, and are addressed in the MSX EA. No cumulative impacts are anticipated from MSX activities at SLC-2W.

d. COMMENT: General. Chapters 1, 2, and 4 should not use the verb "will." The EA should instead use "would" to signify the conditional nature of an EIS.

RESPONSE: The EA was reviewed and revised where appropriate to ensure the conditional nature of an EA and to take into account the "spirit" of this comment. However, SDIO-prepared environmental documents normally use "will", as is done in the MSX EA.

AF/CEVP (Continued)

e. COMMENT: General. Discussion of contractor-owned, contractor-operated (COCO) is not necessary in environmental analyses. If such discussion is to be included, a thorough evaluation of the potential impacts is necessary. The EA as written contains conclusions regarding fabrication and manufacturing issues without data necessary to support such conclusions. Also, if impacts associated with the manufacturing of the project at COCOs must be analyzed, then a discussion of alternatives relating to manufacture is needed.

RESPONSE: SDIO includes an explanation and analysis of activities at key participating facilities, both Government and contractor, in all environmental documents. The questionnaire from which information was acquired for the contractor-owned, contractor-operated (COCO) facilities was added as an appendix. The completed questionnaires are part of the administrative file for the MSX EA.

f. COMMENT: Page F-2, and E-2. It seems that text is missing between "Johns Hopkins University/Applied Physics Laboratory" and "MIT/LL."

RESPONSE: Missing text has been inserted in both locations.

g. COMMENT: Page F-4, para 2. If Minuteman I flights have the potential to impact resources, you should state how those were mitigated to achieve a FONSI in the Minuteman and Thor Missile EA.

RESPONSE: The referenced discussion has been removed from page F-4 during editing of the final EA. However, an expanded discussion also appears in Section 2.1.8, and clarifies the intent.

h. COMMENT: Chapter 2, general. Suggest that evaluation of impacts be excluded from this section. State only the proposed action and the alternatives. If an evaluation is made, it should be in a summary at the end of the chapter to allow the reader to make a comparison of alternatives.

AF/CEVP (Continued)

RESPONSE: Chapter 2 was reviewed to exclude evaluations. SDIO includes a summary of other NEPA documents to be "incorporated by reference" in the DOPAA. The issues are discussed, including evaluations of relevant impacts and the mitigations listed that are to be incorporated into the receiving document. Relevant information for background and context purposes can be cited in other sections but an encyclopedic discussion is to be avoided.

i. COMMENT: Page 2-12, para 4. Text is missing between "will be" and "with."

RESPONSE: The word "mated" has been added to the text.

j. COMMENT: Page 2-13, etc. Update references to the Western Space and Missile Center (WSMC) and the Western Test Range (WTR). WSMC is now the 30th Space Wing (30SPW) and the WTR is now the Western Range (WR). However, WSMC Regulation 127-1 is still a correct name.

RESPONSE: Text has been updated in section 2.1.5.1.

k. COMMENT: Page 2-13, Section 2.1.5.1, para 2 and Section 2.1.5.2, para 1. Safety at the launch site is the responsibility of 30 SPW/SE (Safety) and not the responsibility of 6595 ATG.

RESPONSE: Text has been updated in section 2.1.5.1 and 2.1.5.2.

l. COMMENT: Page 3-4, para 2, second sentence. Recreation is not prohibited along the northern shoreline.

RESPONSE: The mention of recreation was not germane and has been deleted.

m. COMMENT: Page 3-4, para 4, line 5. Change "5,950" to "3401."

RESPONSE: Number has been updated.

AF/CEVP (Continued)

n. COMMENT: Page 3-5, para 2. Change to read, "Vandenberg AFB is part of the California Central Coast Basin. Historically recorded data from State and Local Air Monitoring Stations (SLAMS) provided the most accurate air quality data for the SLC-2W launch site area. Up to May 1988, the SLAMS recorded levels of ozone (O), carbon monoxide (CO), sulfur dioxide (SO), oxides of nitrogen (NO), particulate matter (PM) and total suspended particulate (TSP). In April 1992, Watt Road Prevention of Significant Deterioration (PSD) site will begin 12 months of preconstruction monitoring for pollutants. The Watt Road station will become the second PSD site located on Vandenberg AFB. These data. . ."

RESPONSE: Suggested wording has been inserted in section 3.2.

o. COMMENT: Page 3-6, para 2 and 3. Will the proposed action have a potential impact on the threatened and endangered species described in this section? If so, in chapter 4 you must discuss specific impacts of the action to all of these species. Only the California Least Tern is addressed in chapter 4. If not, then omit the discussion of these species in chapter 3.

RESPONSE: The processing, handling and launch of the MSX payload on a Delta II at the SLC-2W was not found to add any additional potential impacts to the threatened and endangered species listed in section 3.2, including the California Least Tern. A list of the species, however, is given for background and context purposes, as it is in the SLC-2W EA. A sentence was added to clarify that only the California Least Tern was at issue for impacts from the launch and thus it is the only species discussed in Chapter 4.

p. COMMENT: Page 3-6, para 4. Delete the Western Snowy Plover from the threatened or endangered species list.

RESPONSE: The Western Snowy Plover listing was corrected from a threatened or endanger species to a Federal Category 1 species as stated in the SLC-2W EA.

AF/CEVP (Continued)

q. COMMENT: Page 4-6, para 1. The SLC-2W EA did not predict that the Delta II vehicle would have a sonic boom. Please validate this statement.

RESPONSE: Sentence was revised to incorporate the estimate of noise levels for the Delta II launch that was used in the SLC-2W EA. See page 4-3, para 2, 6th sentence of SLC-2W EA.